TITLE
The ingestion of a sodium loaded sports drink during simulated flat water kayaking does not improve performance.

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The ingestion of a sodium loaded sports drink during simulated flat water kayaking does not improve performance

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Introduction

Exercise in the heat induces an increased heat stress that challenges the thermoregulatory system; this further challenges the circulatory system to maintain blood flow to the exercising muscles whilst re-distributing blood flow to the skin in order to sustain continued heat loss.

Inadequate fluid replacement can compromise thermoregulation and exercise performance in the heat. Hence, maintaining a good hydration status plays an essential role in preventing fluid and electrolyte loss and continued exercise performance.

Inducing hypervolemia and increasing the size of the plasma volume can help to sustain and even increase blood flow to the skin and exercising muscles; helping to maintain both thermoregulation and exercise performance.

Inducing hypervolemia through infusion or overdrinking are both unrealistic, whilst glycerol containing solutions have been shown to have mixed results and often accompanied with some side effects.

The ingestion of a high-sodium loaded drink (164 mmol $Na^+.L^{-1}$) prior to exercise has been shown to induce hypervolemia and hyperhydration, leading to an improved performance.

The effect of supplementing with a high-sodium drink during exercise has yet to be examined; therefore the purpose of the study was to determine the effect of ingesting a high-sodium loaded drink during exercise in the heat.

Method

Participants

Eight male and one female, healthy, non-smoking ,well trained flat water kayak paddlers were recruited from a local kayak club for the study. The study was approved by St Mary's University College Ethics Committee. Each subject gave written informed consent.

Table 1. Mean age, height and mass of the nine participants (mean ± SD).

Age (years)	Height (cm)	Body Mass (kg)
20.7 ± 3.3	181.1 ± 8.8	79.5 ± 13

Research Design

A single blind, randomised, crossover design was used over the four week testing period. A kayak ergometer (Dansprint; Denmark), individually calibrated to a flywheel speed of 27, was used for each session. The environmental conditions were maintained at 30ºC and 48% relative humidity during each session.

Baseline testing involved a 1000 m time trial followed by 2 x 3 minute practice efforts at 70% MPO (% mean power output from the 1000 m time trial). The two practice efforts acted as familiarization for the main testing sessions.

Each of the three randomized experimental trials were conducted at the same time of day, and consisted of a simulated training session (3 min on / 3 min off x 8) at 70% MPO. Following the session participants had a 5 min rest period before completing a 1000 m time trial performance.

During each trial each subject consumed either a 10 $ml.kg^{-1}$ body mass control drink (no sodium), a low sodium content drink (10 mmol $Na^+.L^{-1}$) or a high sodium content drink (164 mmol $Na^+.L^{-1}$), made up of fruit squash and water, chilled overnight at 4ºC to aid palatability. The drink was served in 10 equal portions, two immediately prior to the session and then one in every rest period.

Method...continued

Standardization

Participants were asked to not consume any sports drinks or alcohol in the 24 hours before each trial and to standardize the effects of plasma volume change on each trial, participants were asked to maintain a fluid diary in the 24 hours prior to the first session. They were then asked to follow the diary for the 24 hours proceeding the remaining two trials.

Participants were informed that the experimental trials were being used to measure the body's physiological responses to each drink, performance as a measure was not stressed.

Measures

Heart rate and core temperature were measured pre and post each trial and in every rest period. 1000 m effort time was measured along with stroke rate and power output for the performance effort. On arrival at the lab participants remained seated for 10 min prior to blood samples being taken to calculate haemoglobin (Hb), haematocrit (Hct) and plasma volume (PV), this procedure was also followed post exercise for consistency between samples. Blood sodium, chloride, pH, glucose, lactate, Hb, Hct and PV were measured via capillary puncture and then a handheld blood analyser (iSTAT, Abbot Point of Care, Birmingham, UK) pre and post each trial. Plasma volume change was calculated with the following formulae:

$$\%\Delta PV = 100\,[((Hb_0 / Hb_t)\,((1-Hct_t) / (1-Hct_0))] - 100\%$$

Where $_0$ equals pre results and $_t$ equals post results. Hb is in grams per 100 mL and Hct is a percentage. Hct was multiplied by 0.96 and then 0.91 to allow for trapped plasma and the venous to whole blood Hct excess.

Data Analysis

A One – Way ANOVA with repeated measure was used to analyse 1000 m time trial performance, power output and stroke rates as well as fluid loss, % plasma volume change, heart rate, core temperature, blood sodium concentration, lactate, haemoglobin and pH.

Results

The ingestion of sodium loaded sports drink had no significant affect on 1000 m time trial performance ($F_{(2,16)} = 0.420$, $p = 0.664$). Analysis of whole blood for [Na^+] revealed a significant increase after ingestion of high Na^+ sports drink ($F_{(2,16)} = 9.100$, $p = 0.002$).

Table 2. Mean 1000 m time trial performance under each condition (mean ± SD)

	High Na^+	Low Na^+	Control
Mean 1000 m Time (seconds)	279.1 ± 21.8	280.9 ± 23.6	278.2 ± 25.5

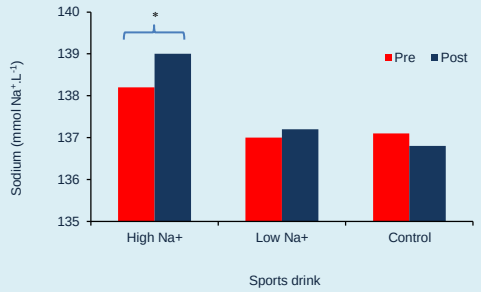

Figure 1. Difference between pre and post blood sodium levels for the three different conditions. ∗Significantly different between pre and post.

Analysis of plasma volume revealed no significant effect of the different sports drink on the percentage of mean plasma volume change pre and post exercise ($F_{(2,16)} = 0.533$, $p = 0.597$).

Table 3. Mean plasma volume change under each condition (mean ± SD)

	High Na^+	Low Na^+	Control
Mean Plasma Volume Change (%)	0.77 ± 2.9	3.03 ± 6.2	2.49 ± 3.4

Conclusion

The results suggest that the ingestion of a sodium loaded drink during exercise has no effect in improving kayak performance despite increases in [Na^+]; however it appears to maintain plasma volume. Further research is required to investigate the use of sodium loaded drinks during exercise.

References

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