Coconut water; a sports drink alternative?

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Introduction

- Endurance exercise can cause significant changes in body water content and electrolyte concentration.
- Potassium plays a crucial role in regulating intracellular fluid volume.
- Sweat excretion includes both sodium and potassium, with potassium loss being lower than sodium (1).
- Previous literature has rarely focused on the importance of maintaining potassium concentration for cycling performance (2-3).
- Beverages derived from coconut juice naturally have high potassium content. However, coconut water alone has low levels of carbohydrates and sodium.
- To enhance the ergogenic effect, the quantity of carbohydrates and sodium in coconut water may need to be increased.
- This study aimed to determine if consuming coconut water supplemented with carbohydrates and sodium, matching a commercially available sports drink, offers any additional performance benefits during endurance cycling.

Methods

- **Study design:** Randomized crossover trial with two exercise trials and different beverage consumption (sports drink and coconut-water-based beverage with added sodium and carbohydrate).
- **Participants:** Initially 23 experienced cyclists, with 19 completing both trials (15 males and 4 females, average age 30 ± 9 years, body mass 79 ± 11 kg, $\dot{V}O_{2\ peak}$ 55 ± 8 mL.kg-^{1}.min^{-1}).
- **Pre-test:** Participants underwent anthropometrical and physiological profiling, familiarization with the performance measure, and an incremental exercise test on a cycling ergometer.
- **Experimental trials:** Participants completed two trials where they consumed either a commercial sports drink or coconut water, with the order randomized. The coconut water contained 1420 mg.L^{-1} potassium, 448 mg.L^{-1} sodium, and 66 g.L^{-1} carbohydrate, while the sports drink contained 132 mg.L^{-1} potassium, 458 mg.L^{-1} sodium, and 55 g.L^{-1} carbohydrate.
- Each trial included a 90-minute pre-load exercise to induce fatigue and dehydration, followed by a simulated 20-km time trial on a cycle ergometer.
- During the pre-load exercise, participants cycled at an intensity equivalent to 65-70% of their peak power output, with high-intensity intervals at specific time points.
- Heart rate, blood lactate, and glucose were measured during the pre-load exercise, and body mass was measured before and after to determine sweat loss.
- **Beverage treatment:** Participants consumed the experimental beverage at a rate of 2.5 mL per kilogram of body mass for each 15-minute segment of the pre-load exercise. Water was consumed ad libitum during the initial 20 km time trial.
- **Data analysis:** Mean values with standard deviation were calculated, and differences between treatments were analysed using one-way analysis of variance (ANOVA). Effect size statistics (d) were also determined to assess the magnitude of the effects.

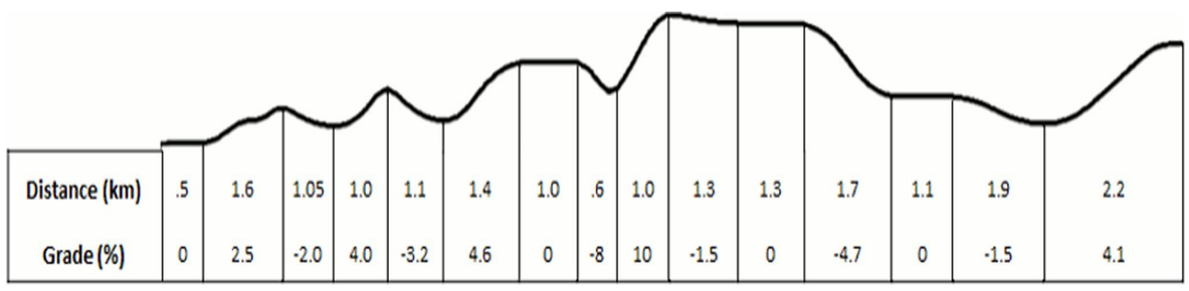

Figure 1. Simulated 20k-m time trial with segment profile

Results

- There were no significant differences between the coconut water and sports drink treatments for any of the measured variables (glucose, lactate, sweat loss, heart rate, time in the time trial, and average power).
- Effect size analysis indicated only trivial differences between treatments, except for blood glucose, which showed a small decrease (d=0.31) in the coconut water trial compared to the sports drink trial.

Table 1. Mean ± SD scores between treatments

	Coconut water	Sports Drink
Glucose (mmol·L^{-1})	5.5±0.5	5.3±0.6
Lactate (mmol·L^{-1})	3.9±2.2	3.8±2.3
Sweat loss (L)	1.2±0.4	1.3±0.5
Heart rate (bpm)	151±19	151±13
TT time (sec)	2863±467	2892±477
TT avg power (W)	208±58	204±60

Table 2. Mean (± 90% CI) percentage difference between treatments.

Coco-Sports mean% difference ± 90% confidence limit		ANOVA P-Value	Effect size (d)	Qualitative inference
Glucose (mmol·L^{-1})	-3.0±3.2	0.29	0.31	Small
Lactate (mmol·L^{-1})	4.2±31.0	0.92	0.07	Trivial
Sweat loss	-5.5±16.6	0.37	0.12	Trivial
Heart rate (bpm)	0.5±2.6	0.77	0.04	Trivial
TT Time (Sec)	-1.0±2.9	0.83	0.06	Trivial
TT Power (W)	2.1±4.9	0.79	0.07	Trivial

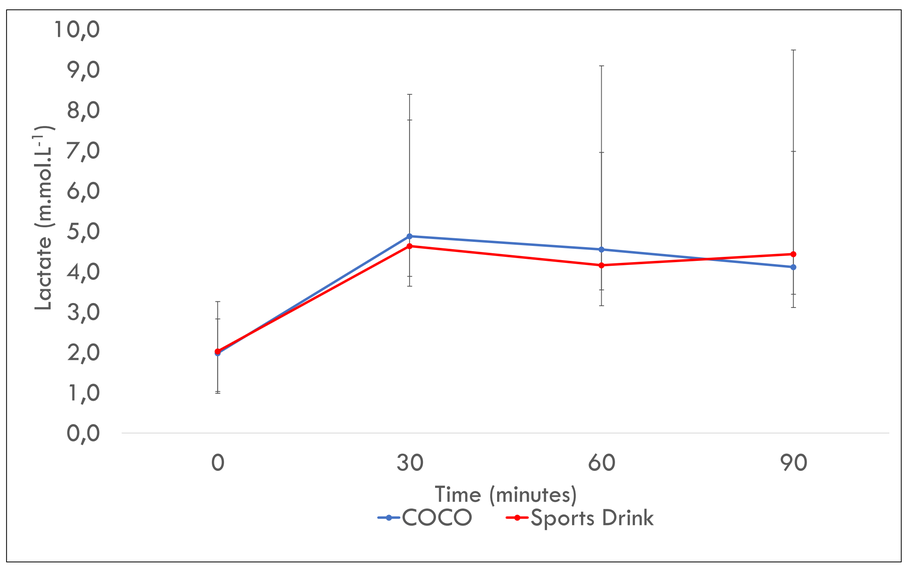

Figure 1. Blood lactate concentrations over the 90-minute pre-load exercise task between the coconut and sports drink trials. Data are expressed as mean±SD.

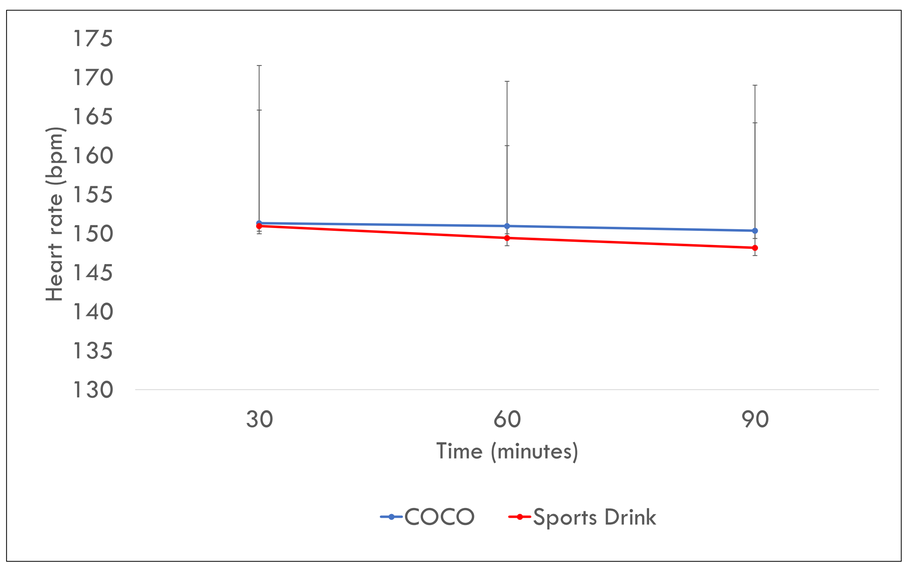

Figure 2. Heart rate response over the 90-minute pre-load exercise task between the coconut water and sports drink trials. Data are expressed as mean±SD.

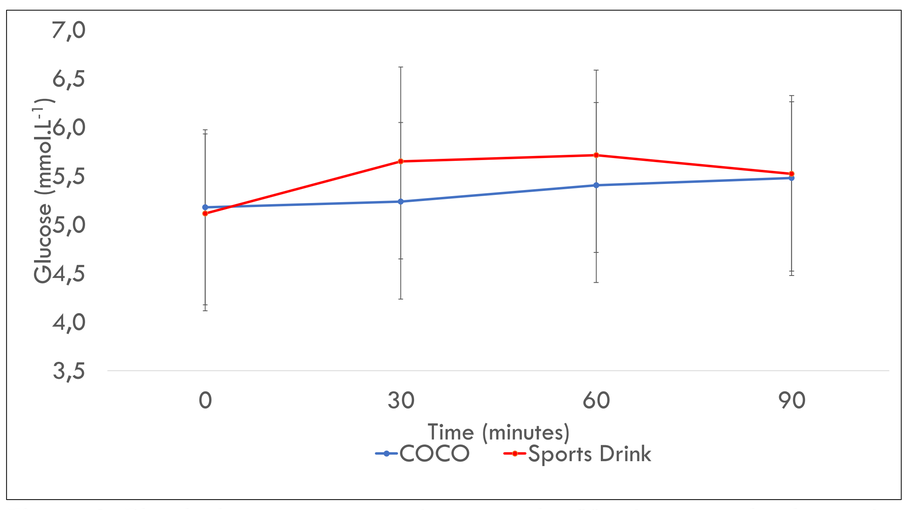

Figure 3. Blood glucose concentration over the 90-minute pre-load exercise task between the coconut water and sports drink trials. Data are expressed as mean±SD.

Conclusion

- Consuming coconut water has a similar effect on cycling time trial performance and physiological responses to consuming a commercially available sports drink.

References

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