

MEETING ABSTRACT

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# Physiological testing of a beverage system designed for long-haul air travel

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## Introduction

Long-haul air travel imposes multiple stressors, arising from prolonged immobility, low humidity, modest hypobaria, circadian disruption and oxidative stress from food and cosmic radiation [1]. We developed a beverage system (Flyhydrate™<sup>a</sup>) to counteract such effects, using ingredients shown in previous research to be effective when used acutely in achievable quantities, with low risk of adverse effects in unscreened populations. Flyhydrate is a 3\*330 mL beverage system based on sodium-citrate and sodium-chloride for hydration, with supplemental ingredients (esp. fruit extracts) for early, mid and/or late phase flying effects. The aim of this study was to determine the physiological effectiveness of Flyhydrate in lab trials that simulated long-haul flying to the extent possible in our testing facilities.

## Methods

In a double-blind, placebo-controlled, crossover design, 12 male adult volunteers (mean (SD): mass 76 (16) kg) underwent two 7-h trials, at least one week apart (both at 24.2 (0.1) °C, 30.4 (1.5)% rh). Participants were seated except for two 10-min periods used for micturition. In each trial, participants consumed a standardised snack, meal and normal fluids (430 mL water, tea and coffee; ad libitum in first trial, then repeated in second trial), and 330 mL of Flyhydrate or equal volumes of equivalently-coloured and flavoured placebo (143 kJ energy and 0.8 mMol sodium) at 0.3, 3.0 and 5.7 h (i.e., 990 mL of each beverage). Each Flyhydrate 330-mL drink, depending on its role, contains 298-913 mg polyphenols, 0-48 g caffeine, 255-288 kJ energy and 21.7 mMol sodium, and has an osmolality of 336-378 mOsmol/kg.

## Results

Urine output across 7 h was  $0.23 \pm 0.16$  L (mean  $\pm$  95% CI;  $p = 0.02$ ) lower in Flyhydrate than in Placebo (1.05 (0.48) vs. 1.28 (0.34) L). Approximately half (0.13 L) of this difference was evident after the first drink ( $p = 0.01$ ). Total body water loss, assessed from bioimpedance analysis, was  $0.4 \pm 0.4$  L less in Flyhydrate ( $p = 0.05$ ), and plasma volume increased by  $3.0 \pm 2.8\%$  ( $p = 0.04$ ) more in Flyhydrate than in Placebo (4.1 vs 1.1%). Flyhydrate provided no clear effect on the seating-induced increase in calf girth (0.5 vs 1.3%  $p = 0.10$ ) or ankle girth (0.2 vs 0.8%;  $p = 0.23$ ). Effects on heart rate were similarly unclear ( $p = 0.70$ ). Oxidative stress, as indicated from plasma concentration of Advanced Oxidative Protein Products, increased by 171% for Flyhydrate and 199% for Placebo, without measurable difference ( $p = 0.50$ ).

## Discussion

Fluid balance and plasma volume were maintained more effectively with Flyhydrate than with a matched volume of placebo beverage, despite the consumption of other fluids. These findings concur with those from a field trial of another sodium-based beverage in long-haul flying [2]. Other potential physiological effects from supplemental ingredients were not discernible in these laboratory trials. Controlled trials involving a more complete representation of the stressors of long-haul air travel appear necessary to examine such effects.

## Conclusion

The customised beverage system maintained fluid balance and plasma volume more effectively than did a placebo beverage, but other potential benefits were unclear in this setting.

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