Postprandial thermogenesis, substrate oxidation and cardiovascular responses to water and sugary drinks

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The consumption of refined sugars in food and beverages has risen sharply in recent decades and is thought to contribute importantly to the current epidemic of obesity, type 2 diabetes and cardiovascular diseases. Because limiting sugar-sweetened beverages has been clearly identified as a simple change that could have a measurable impact on weight control and associated cardiometabolic diseases, there is nowadays considerable interest for weight control strategies that focus on alternative beverages. These range from the substitution of sugar-sweetened beverages by water and other energy-free “diet” beverages to increasing low-fat milk consumption and other “functional” beverages containing bioactive ingredients (e.g. specific amino-acids, minerals, polyphenols) that may impact on energy intake, glycemic control, blood pressure regulation, exercise performance and thermogenesis. In this context, the main aims of this thesis work were to investigate, in young men and women, (i) the potential thermogenic and fat oxidizing properties of drinking 500 ml of pure water, (ii) whether these metabolic properties are augmented by modest amounts of bicarbonates (NaHCO₃) often found in natural mineral waters and (iii) to evaluate the thermogenic and cardiovascular effects of ingesting sugary drinks containing the low-glycemic milk sugar galactose in comparison to glucose and fructose.

Using the ventilated hood indirect calorimetry to assess continuously resting energy expenditure and respiratory quotient, for at least 30 min before and 120 min after the test drink, and continuous cardiovascular (beat-by-beat) monitoring, the results indicate that:

I. Ingestion of pure (distilled) water did not result in greater stimulation of thermogenesis nor did it promote greater fat oxidation beyond that observed with Sham drinking, independently of gender, body composition or abdominal obesity.

II. Ingestion of water together with capsules containing NaHCO₃ in amounts often present in moderate-to-high mineral water, as well as drinking a natural low-mineralized water containing moderate amounts of NaHCO₃, resulted in increased thermogenesis without a change in the composition of fuel substrate oxidized. These thermogenic effects are quantitatively small but occur rapidly and are sustained for at least 2 hours.

III. In response to the ingestion of 60g of galactose, the stimulation of thermogenesis was similar to that for glucose, while the changes in substrate utilization were closer to those for fructose. In relation to hemodynamics, galactose resembles glucose in its marginal impact on blood pressure, which contrasts with the significant blood pressure elevating effect of fructose. Furthermore, galactose ingestion resulted in lesser increases in heart rate and cardiac output compared to glucose.

Amid considerable controversies concerning the metabolic properties of water, our study clearly demonstrates that the ingestion of half-a-litre of pure water per se had little or no impact on thermogenesis and fat oxidation, but that the thermogenic effect of water may be enhanced by the presence of modest amounts of bicarbonates often found in natural mineral waters. Our studies also indicate that the milk-sugar galactose, in addition to its low-glycemic index, presents another interesting characteristic in its mild cardiovascular impact, and is hence of potential interest as an alternative sugar, in particular for those with cardiac insufficiency.

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