

Post-exercise rehydration: the emerging role of milk



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Exercise and fluid balance

Losses

Skin

Respiratory tract

Urinary system

GI tract



Gains

Food and Drink

Metabolism

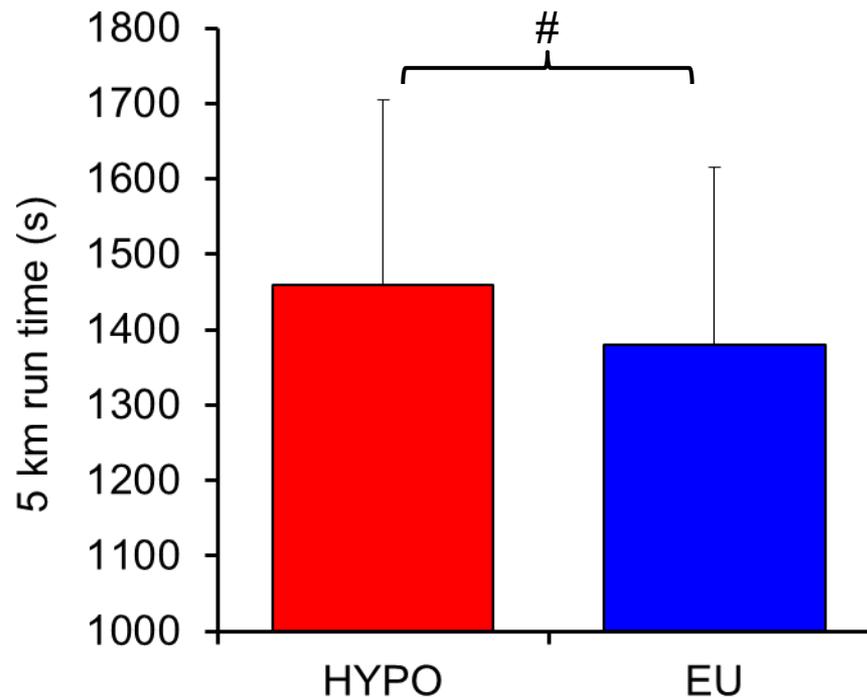
Intravenous

Hypohydration (dehydration) and exercise performance



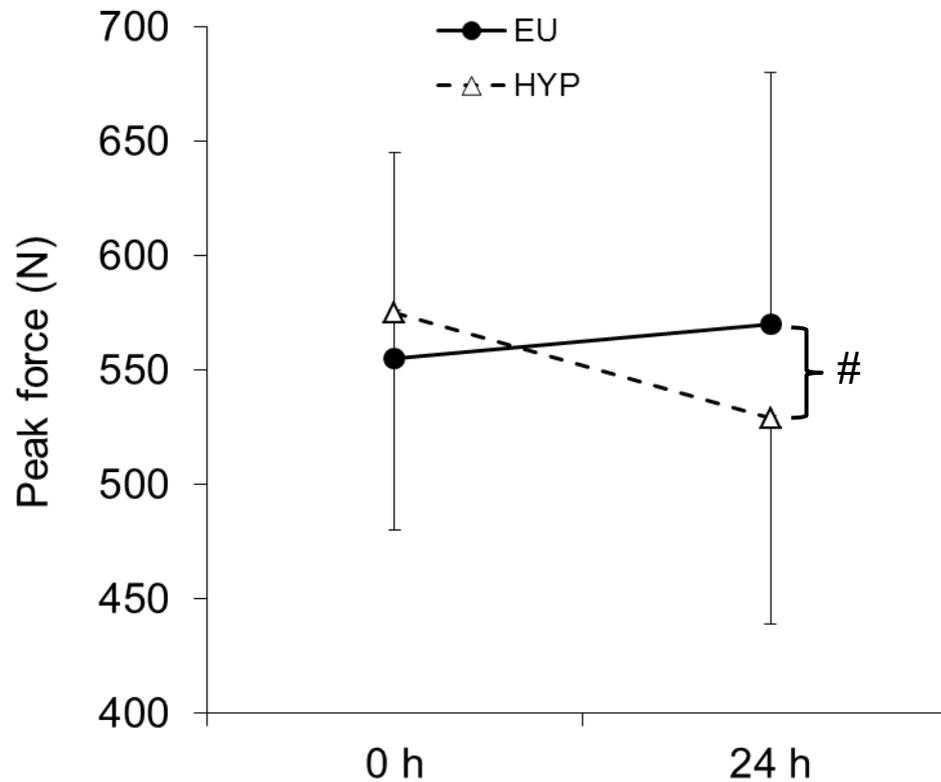
Hypohydration and endurance

- Starting endurance exercise hypohydrated **impairs** performance



Hypohydration and strength

- Starting strength exercise hypohydrated **impairs** performance



Post-exercise rehydration/ recovery



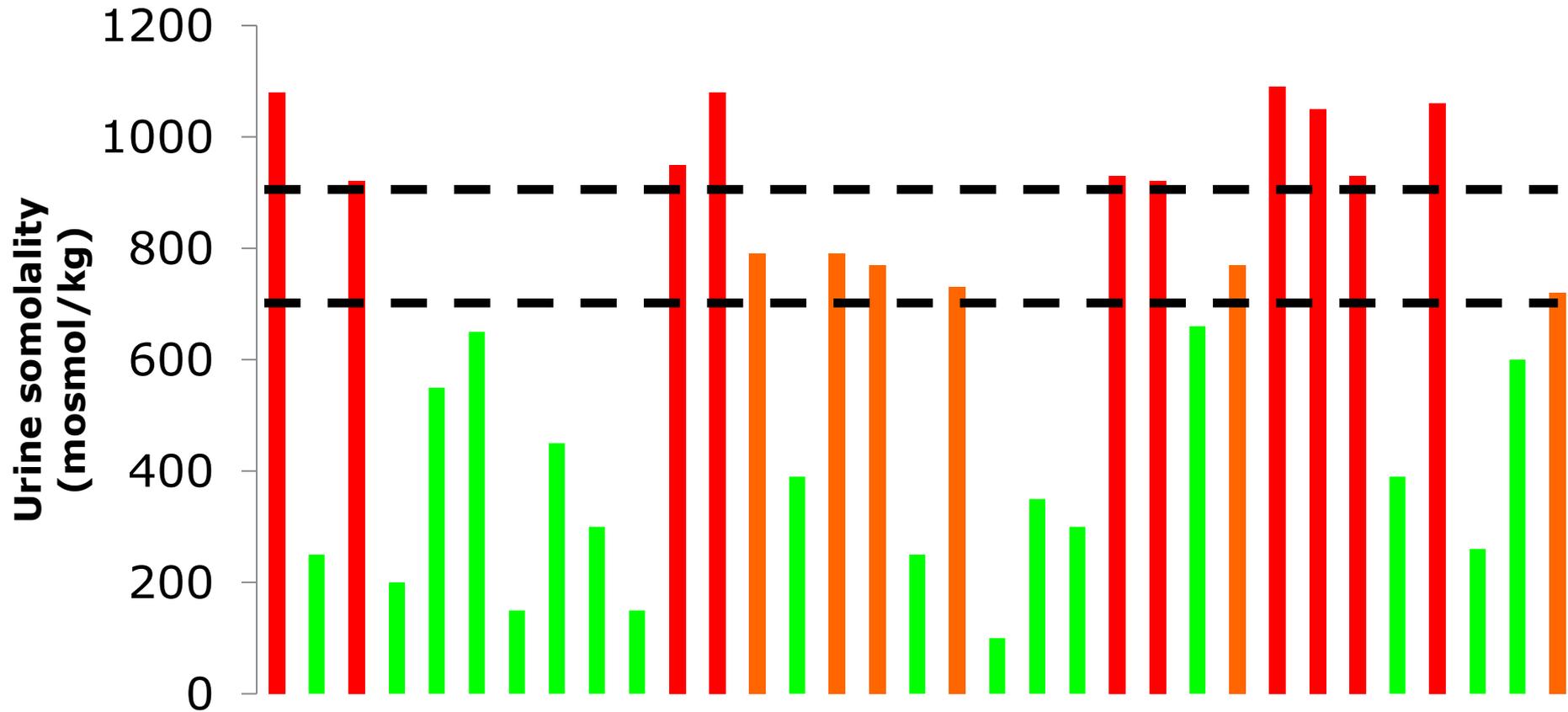
Post-exercise rehydration/ recovery

- Post-exercise nutrition requirements are multifaceted
- Guidelines for drinking strategies during exercise are moving towards “drinking to thirst”
- For athletes, one session’s post-exercise nutrition is the next session’s pre-exercise nutrition

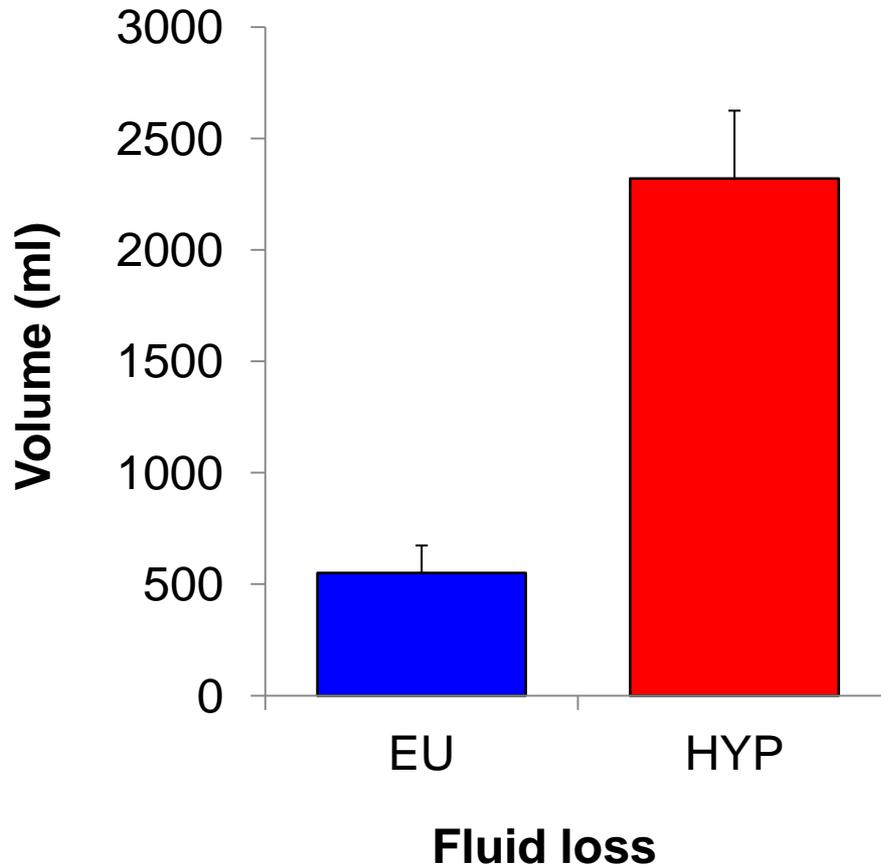


Is there a problem with rehydration?

■ 33 university athletes



Voluntary rehydration



Post-exercise rehydration process

Mouth (drink ingestion)

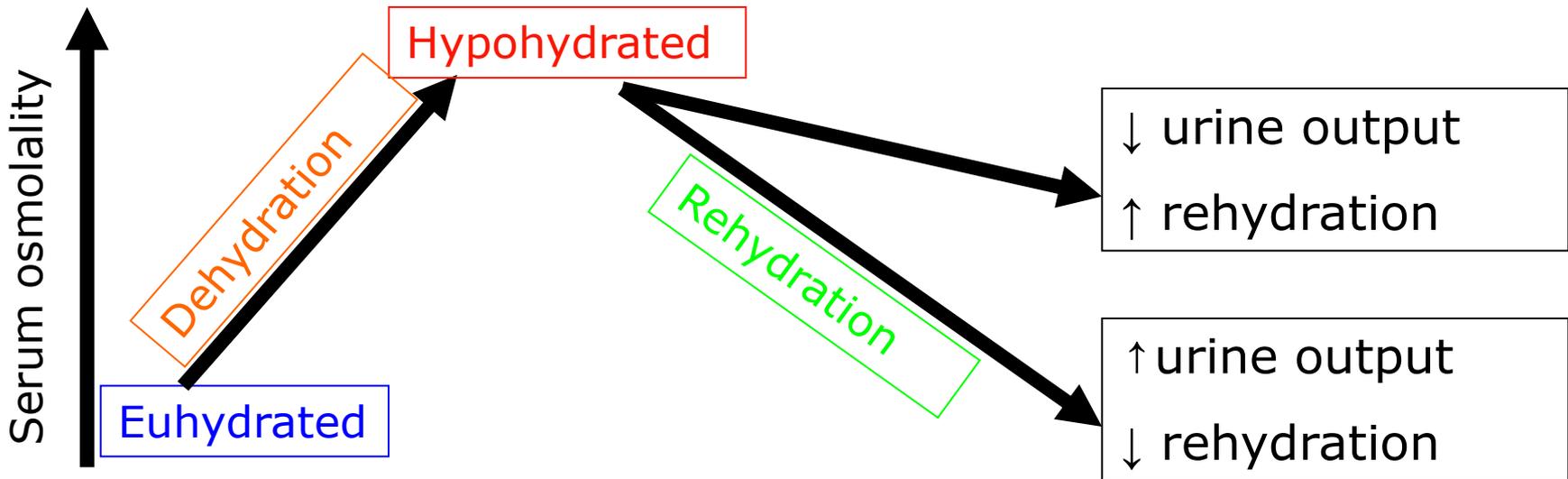
Stomach (gastric emptying)

Small intestine (intestinal absorption)

Circulation (retention)

Post-exercise rehydration

- Effect rehydration drink has on serum osmolality and consequently arginine vasopressin (AVP) will determine how much drink is retained



Post-exercise rehydration

- Effect rehydration drink has on serum osmolality and consequently arginine vasopressin (AVP) will determine how much drink is retained

- Two ways a drinking strategy can improve rehydration
 1. Slow the rate of delivery to the circulation and thus influence hemodilution and serum osmolality

 2. Addition of ingredients that influence osmotic/ oncotic pressure once drink reaches the circulation

Rehydration study design

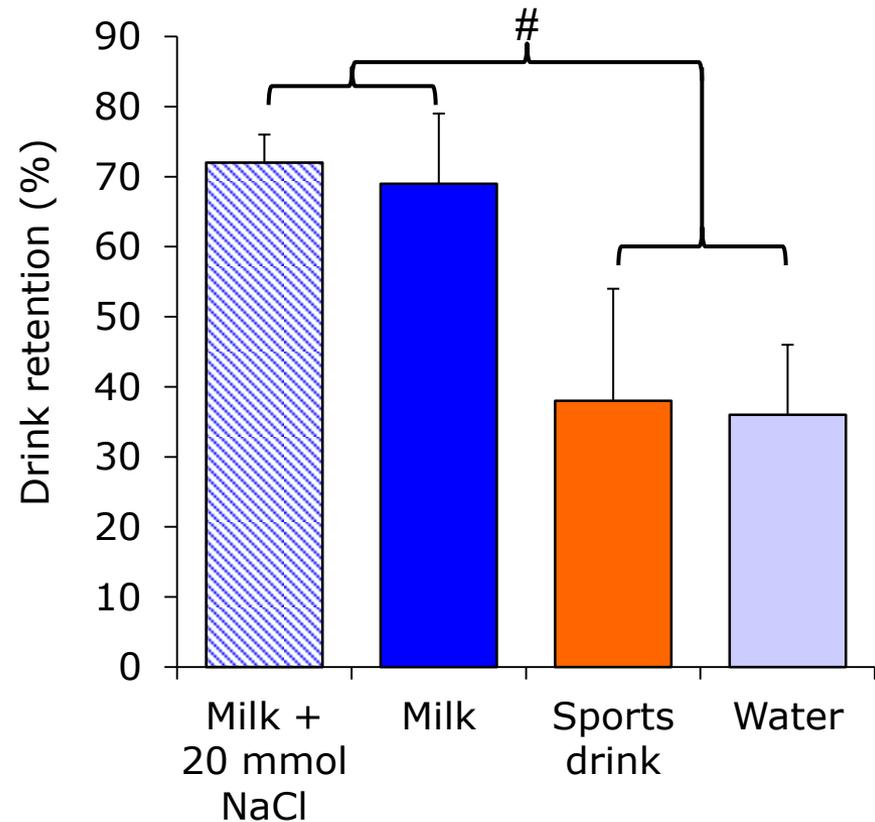
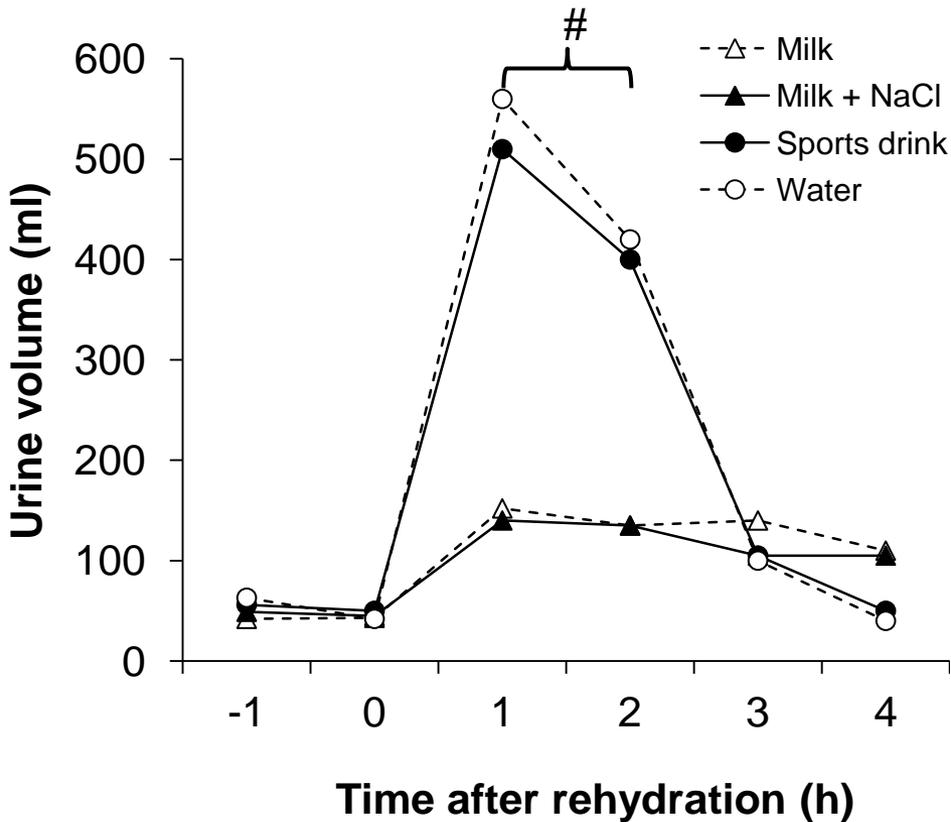
- **Dehydration phase:** ~2% reduction in body mass by intermittent exercise in the heat
- **Rehydration phase:** Consume 100-150% body mass lost during exercise usually over 1 h
- **Monitoring phase:** Rest in the laboratory
- Urine samples
- Body mass
- Other measures



Example timings

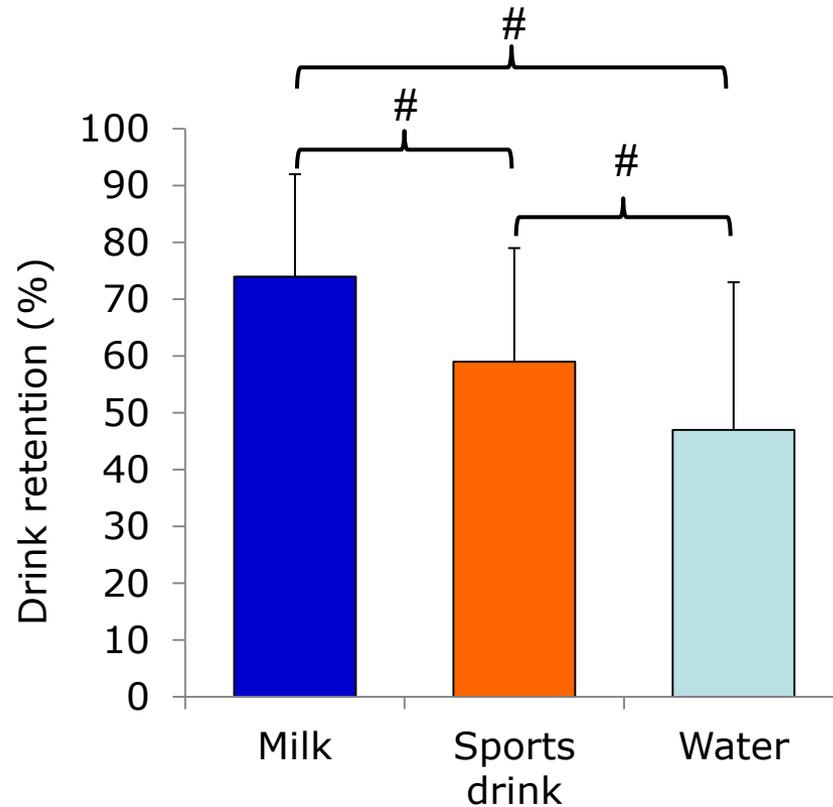
Milk and rehydration

- Skimmed milk **enhances** post-exercise rehydration in adults



Milk and rehydration

- Skimmed milk **enhances** post-exercise rehydration in youths



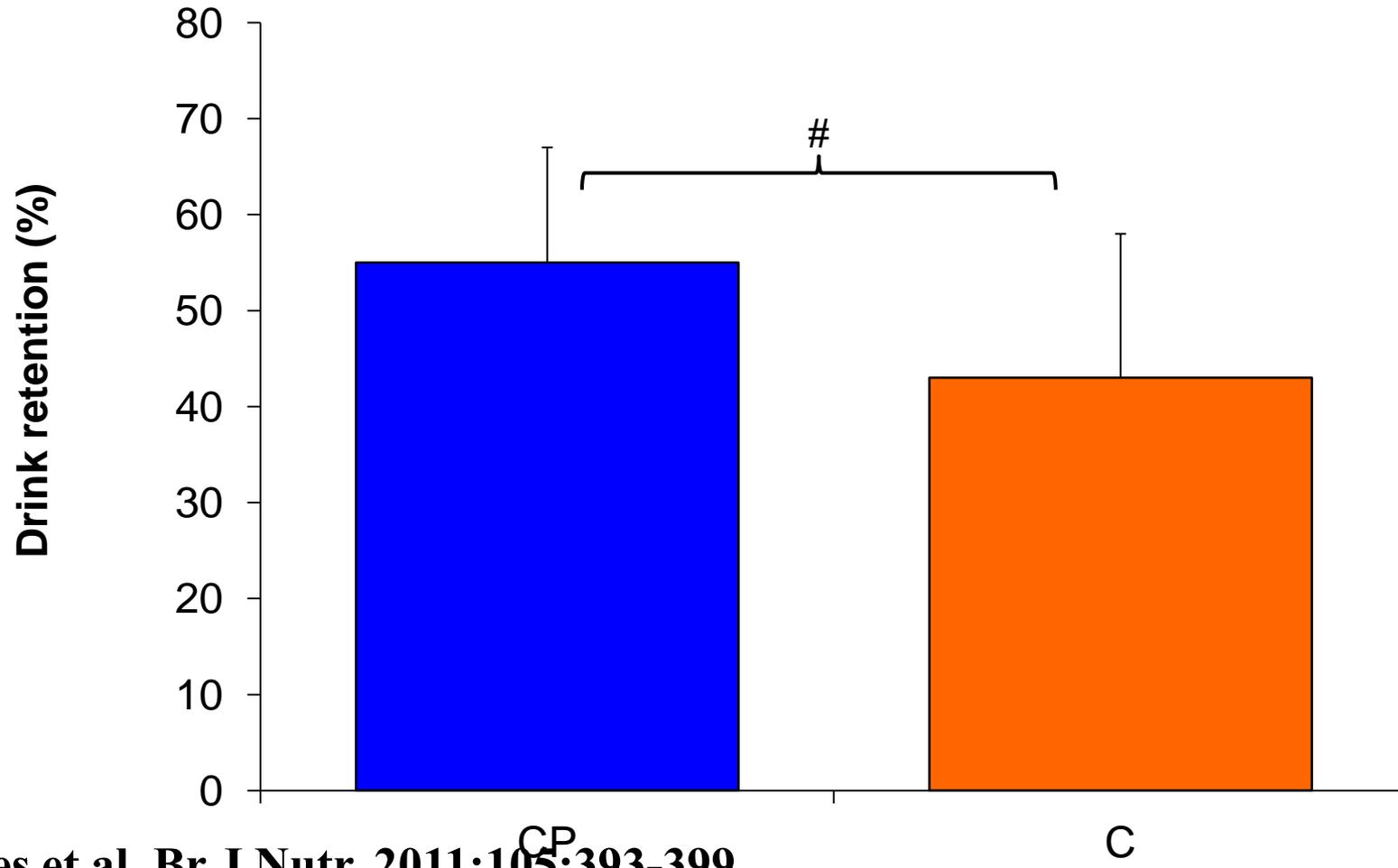
What accounts for this?

- Values are per litre

	Skimmed Milk	Sports drink
Energy (kcal)	367	240
Protein (g)	36	0
Carbohydrate (g)	49	60
Fat (g)	3	0
Sodium (mmol)	20	23
Potassium (mmol)	43	2

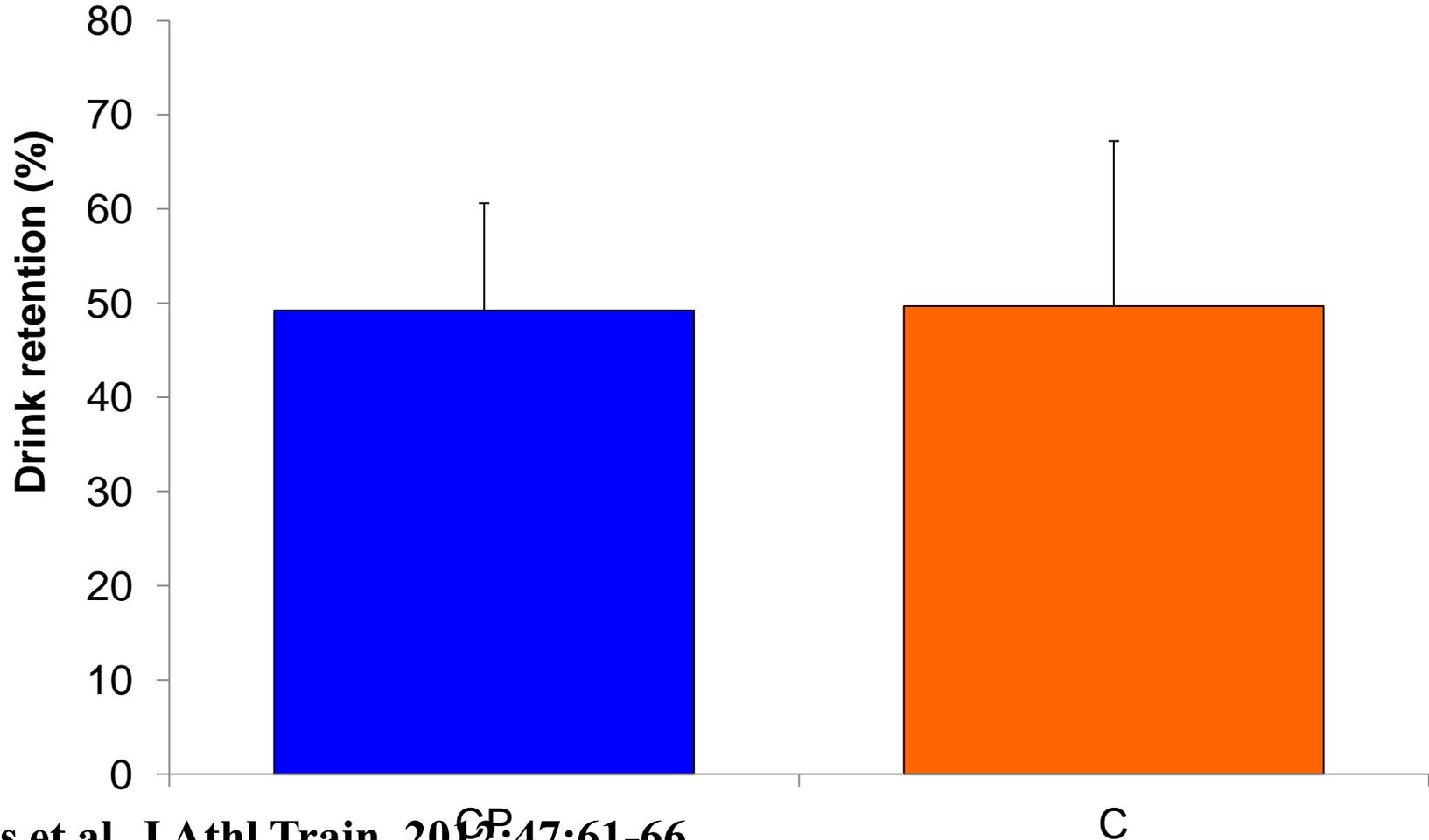
Milk protein and rehydration

- Milk protein **enhances** post-exercise rehydration



Whey protein and rehydration

- Whey protein **does not enhance** post-exercise rehydration

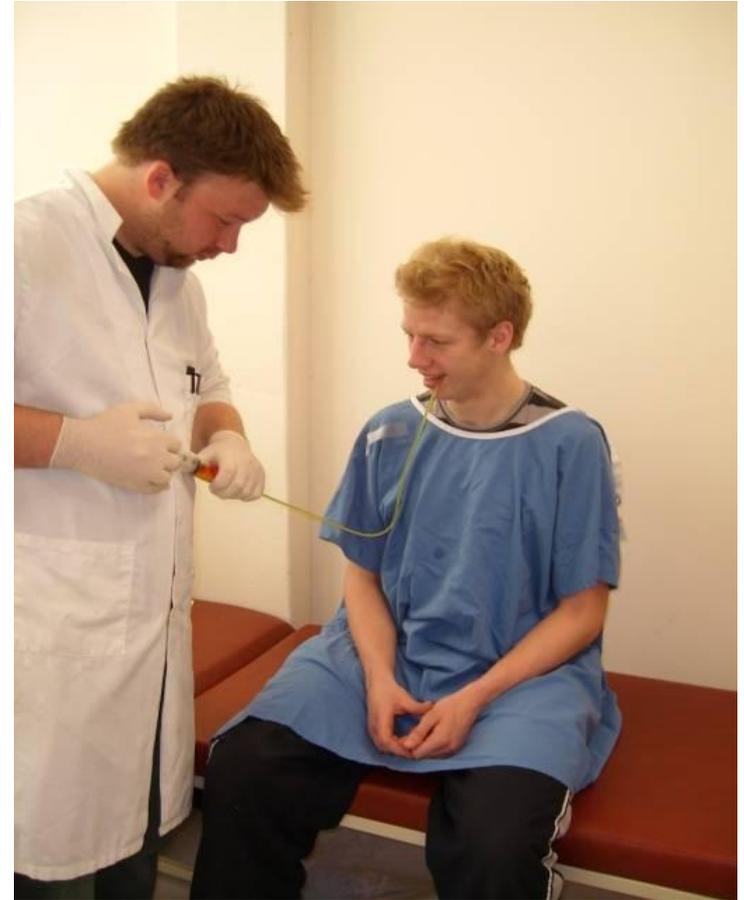
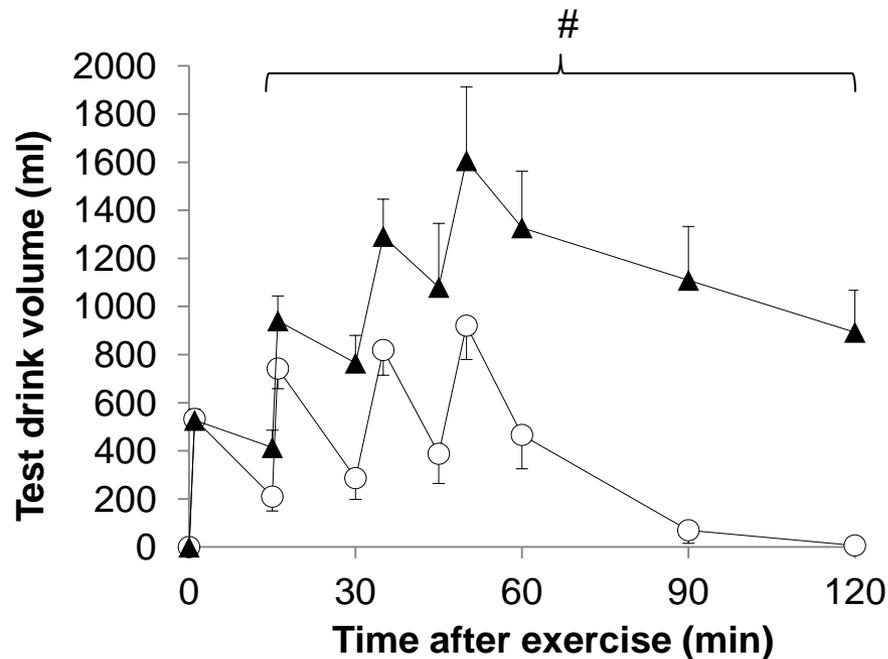


Mechanisms?

- Milk/ milk protein might delay gastric emptying and slow fluid delivery to the circulation, thus increasing rehydration
- Protein ingestion might increase plasma albumin content and increases oncotic pressure, thus increasing rehydration

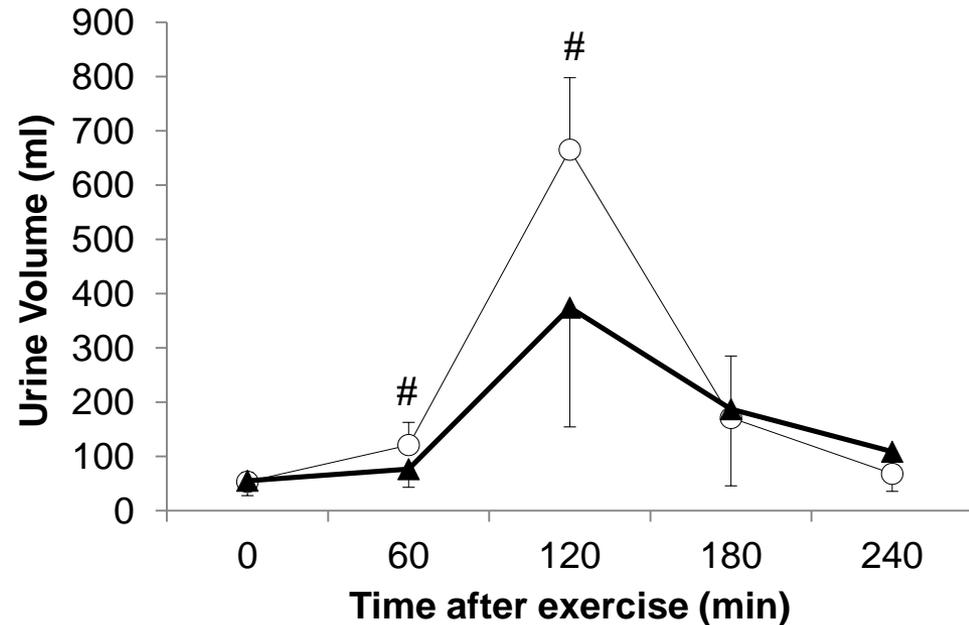
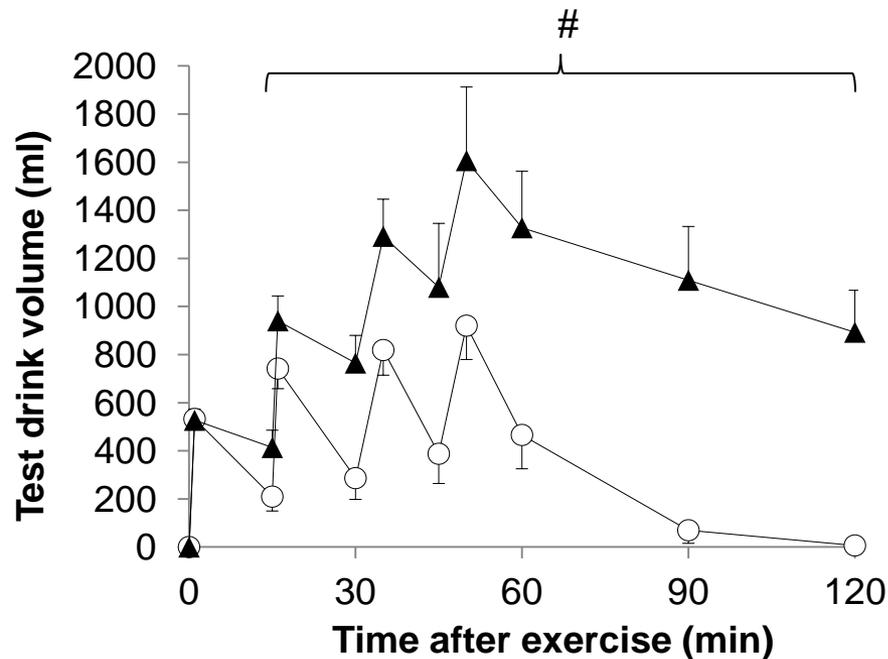
Mechanisms- slower delivery?

- Additional energy (carbohydrate) slows gastric emptying and **enhances** post-exercise rehydration



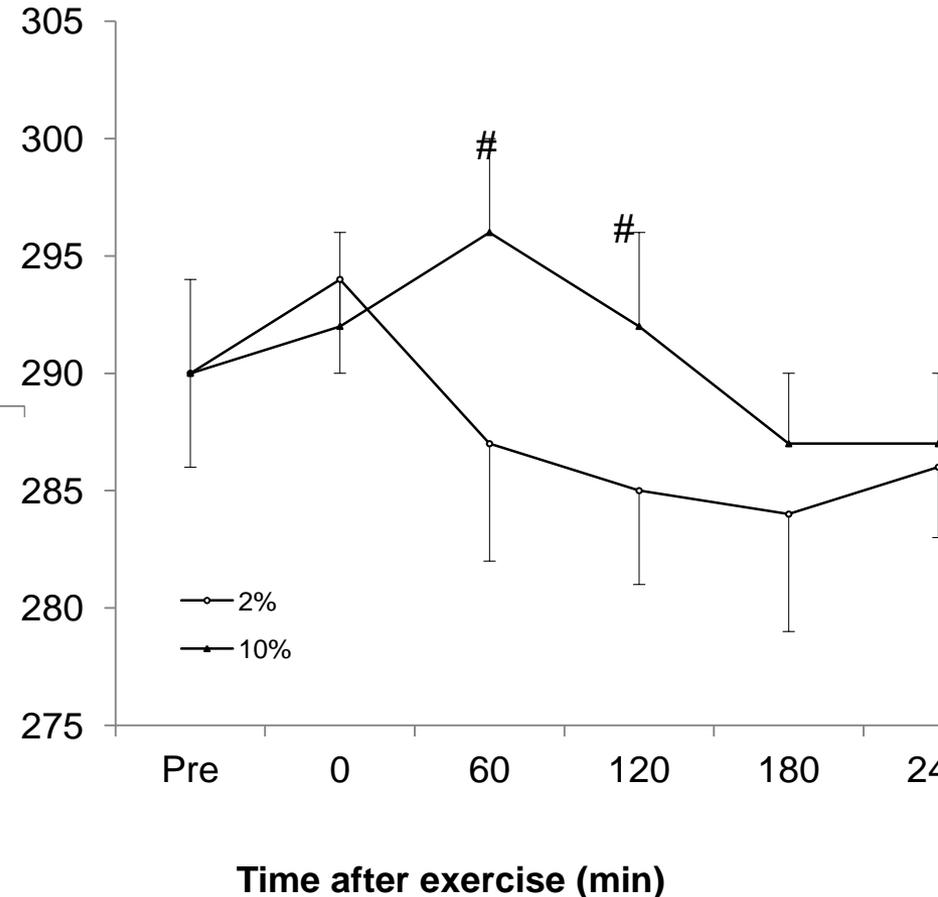
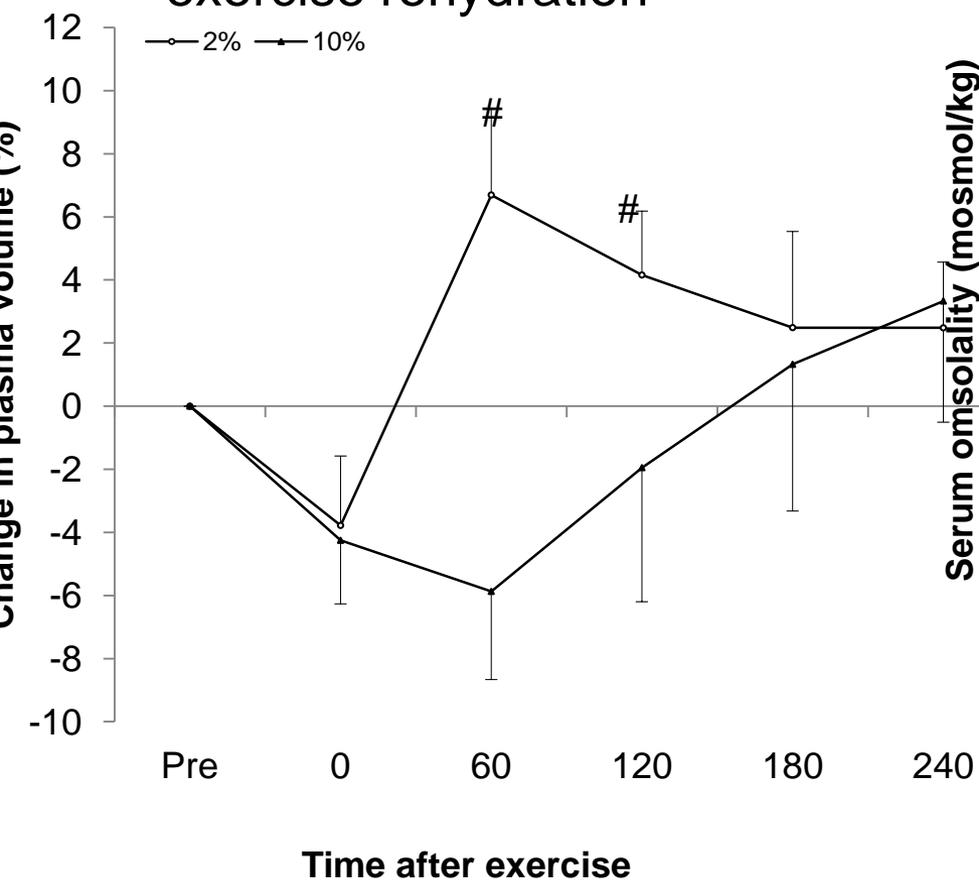
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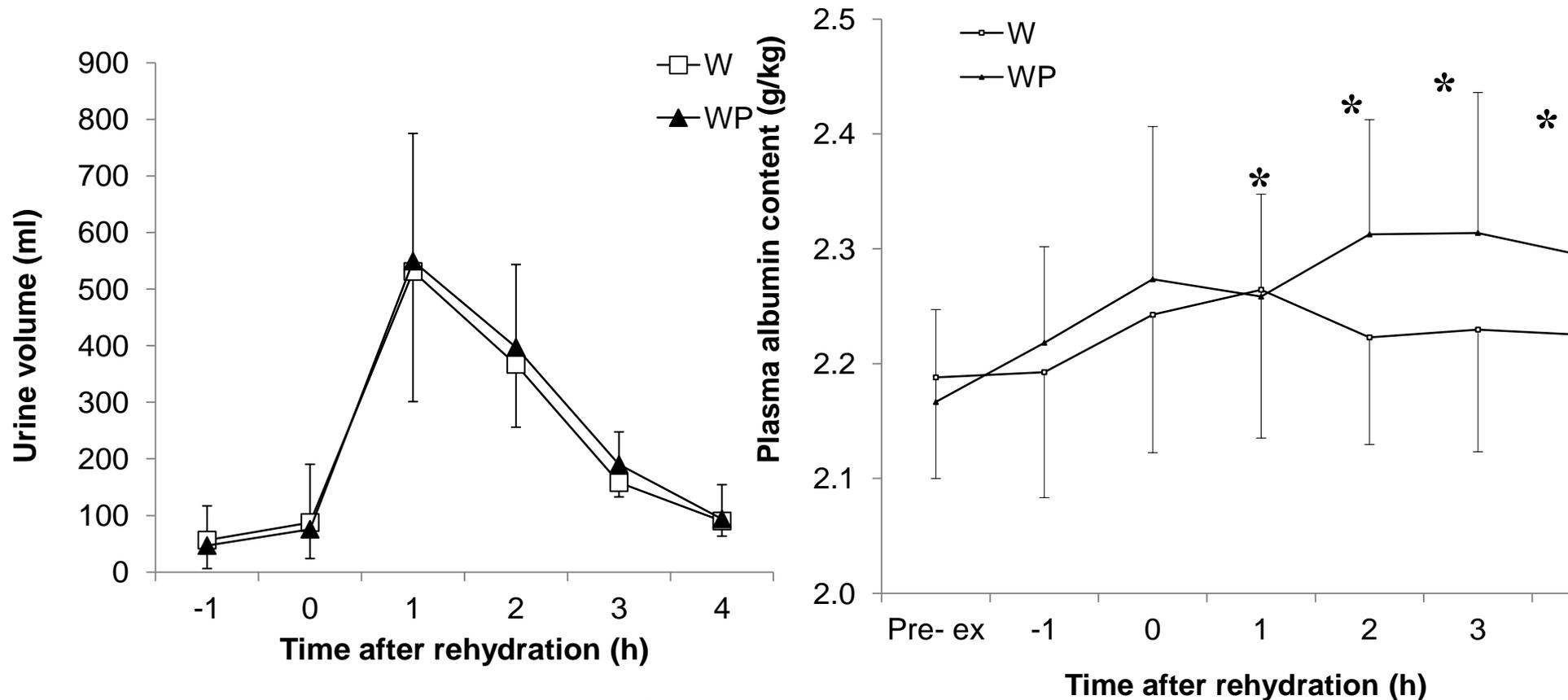
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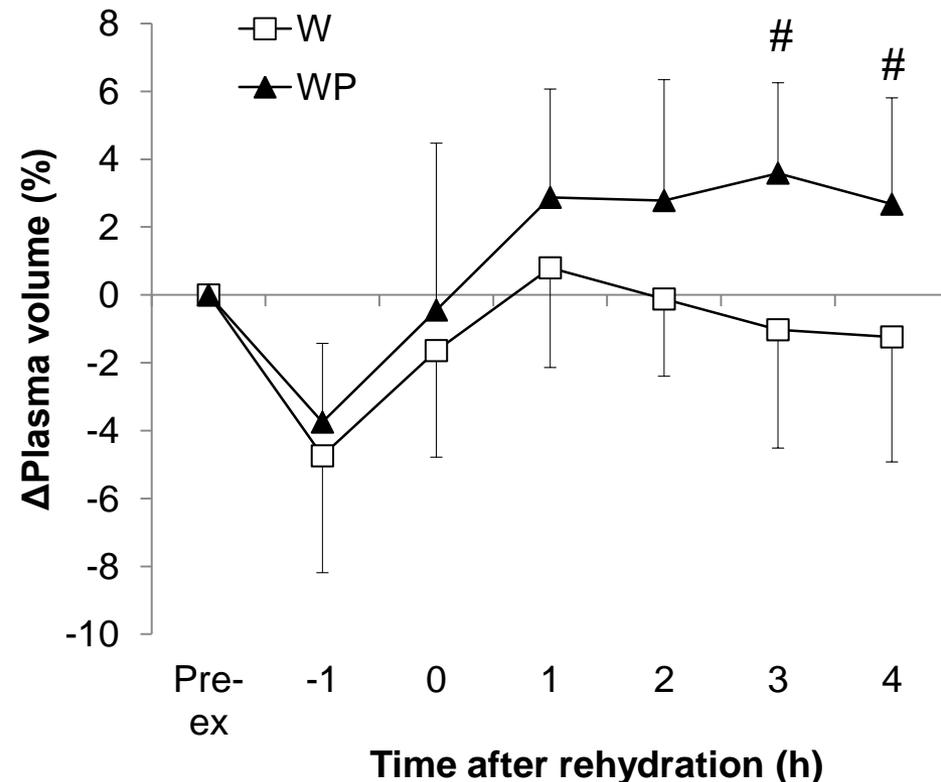
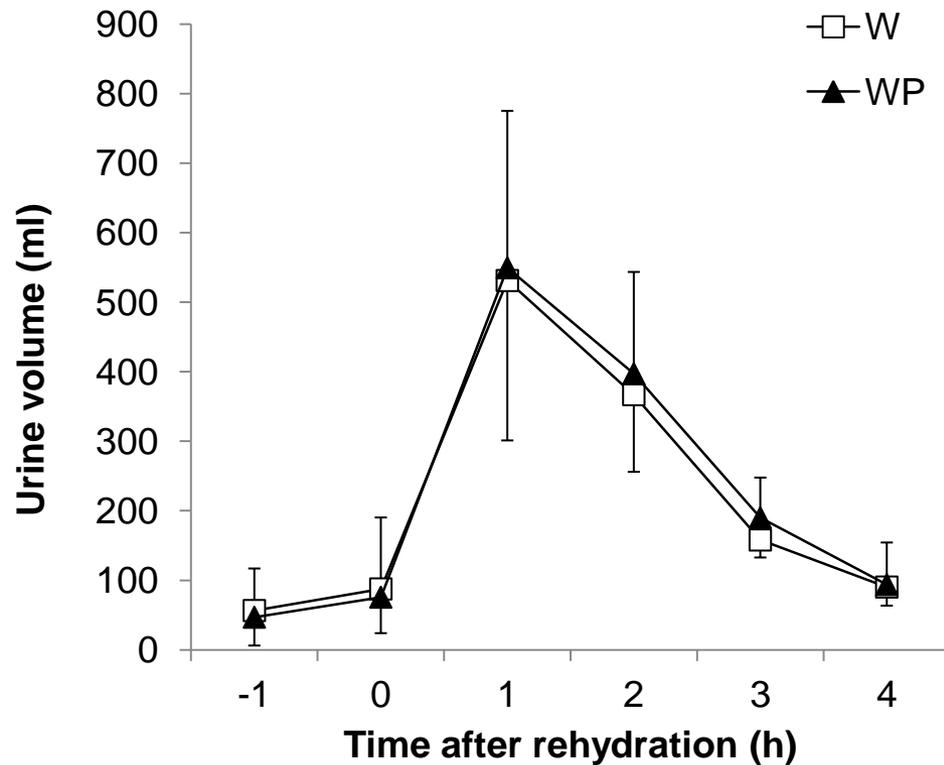
Mechanisms- oncotic pressure?

- Whey protein **increases** plasma albumin content (oncotic pressure) and plasma volume



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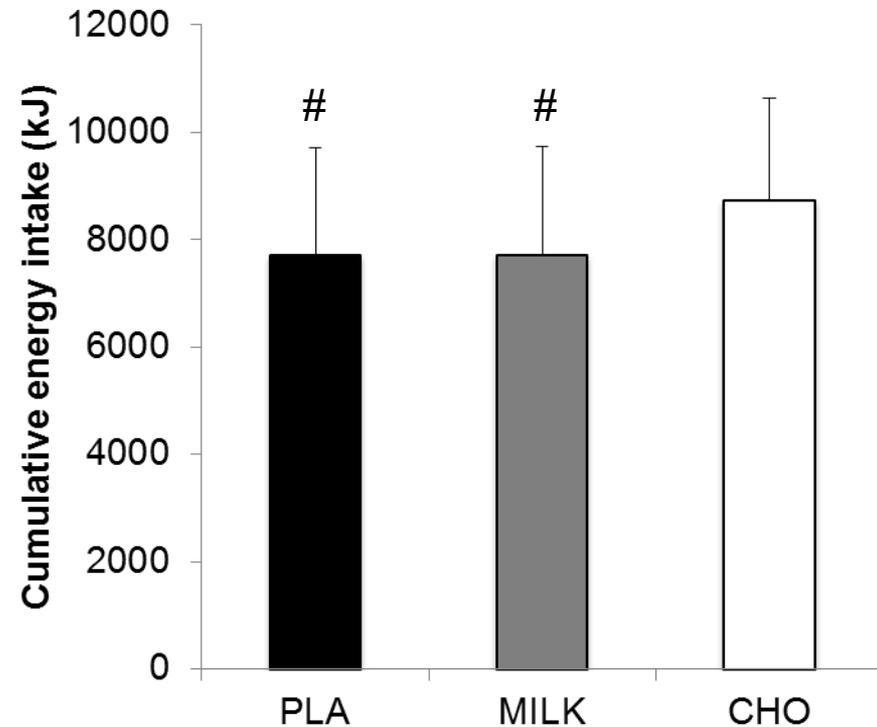
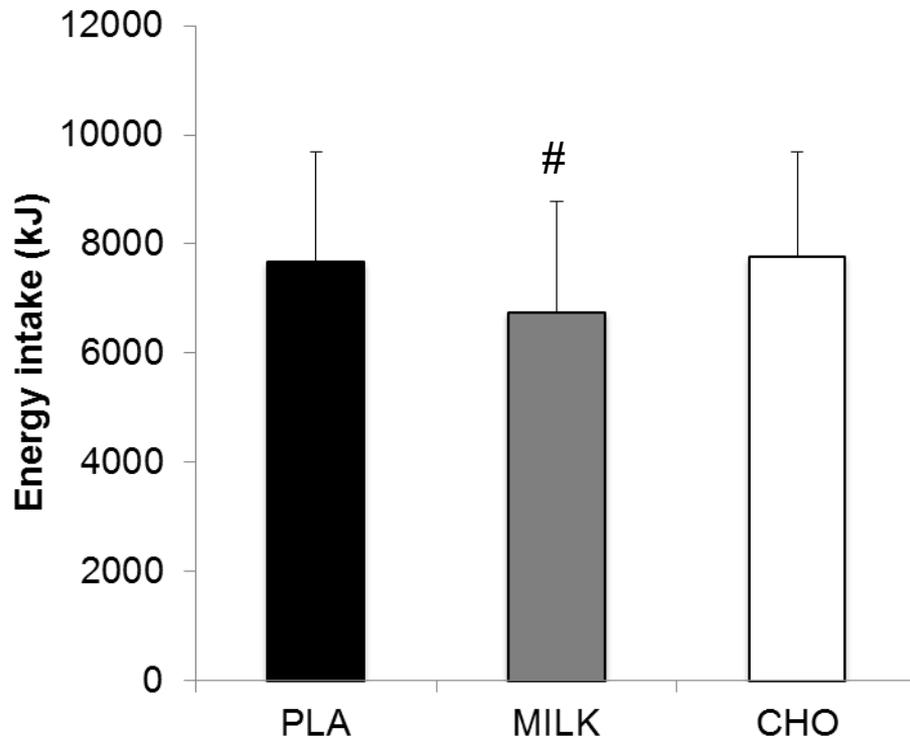


What about energy balance?



What about energy balance?

- Post-exercise milk intake **reduces** subsequent energy intake- energy consumed in the milk is compensated for later



Conclusions

- Milk enhances post-exercise rehydration
 - Milk protein explains some of this effect
- Whey protein does not enhance or inhibit rehydration if 150% fluid loss is consumed in 1 h
 - Might enhance rehydration at slower ingestion rate
- Likely mechanisms are a slowing of gastric emptying and/or increased plasma albumin
- Post-exercise milk ingestion reduces subsequent energy intake and maintains the energy deficit created by exercise

Conclusions

- Milk is a cheap and readily available food that enhances rehydration, as well as other components of recovery.
- Therefore milk has a wide range of sport, exercise and health applications, particularly if consumed post-exercise

Thank you!!

Collaborators

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Questions?

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