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HYDRATION and Consequences of Dehydration

Physiological Importance of Proper Hydration:

Body fluids are composed primarily of water and salt (sodium chloride (~1.5g/day)) with small amounts of potassium (3-5g/day) (a.k.a. electrolytes). Water and electrolytes in body fluids are important to exercise performance by:

(1) maintaining blood volume and osmolarity in order transport and transfer oxygen
(2) thermoregulation (regulation of body temp.) to avoid dehydration through an adequate supply of water for proper sweat production
(3) shock absorbing and lubricating properties
(4) homeostasis of metabolic and enzymatic functions

Loss of body fluids (dehydration) containing water and electrolytes during exercise is mostly by sweating. Dehydration is associated with increases in body temperature and **decreases in blood volume (decreased stroke volume)**. This leads to decreases in muscular endurance and strength, and overall physical performance.

Q	=	SV	x	HR
(Cardiac Output)		(Stoke Volume)		(Heart Rate)
ml / min		ml / beat		beats / min

DEHYDRATION: Q = ↓ SV x ↑ HR

Extreme Weather Conditions: Summer vs. Winter

Very COLD weather: Generally NOT a problem when concerning hydration status. Nevertheless, proper clothing can assure proper sweat rates, since hydration, and ultimately heat disorders, can also occur when the clothing worn by the athlete prevents or limits the ability of the body to dissipate the heat generated by the exercising muscles. (when muscles contract during exercise about 75% of the energy used is covered to heat, therefore you need adequate cooling systems- both drinking water and clothing).

Very HOT weather: The high sweat rates (0.5 to over 2 L/hour) in hot, and especially humid, weather that are needed to adequately cool the body via evaporation during exercise can lead to excessive losses of water and electrolytes. As little as a 1% to 3% loss in body weight caused by dehydration can impair exercise performance. Just a 2% loss in body weight can lead to a 7% increase in 10km run times!

- It can not be emphasized enough that adequate fluid replacement, equal to what is lost in the sweat, is essential for preventing dehydration and thermal injury-

Fluid and Carbohydrates Before and During Training and Racing:

Water Ingestion:

- Drink ~500ml of cold water with dilute electrolyte 20-30 min before exercise
- During exercise, every 15-20min drink 100-200 cold water/electrolyte
- Try for a total of 1.4 - 4.0 L /hour (amounts greater than 2L/h is difficult)

Note: Thirst is NOT an adequate indicator of dehydration. Liquids must be consumed *before* thirst is noticed. Also, choose water or dilute electrolyte solutions that are good tasting to encourage liquid consumption.

Carbohydrate Supplementation During Exercise:

Carbohydrate ingestion during exercise can improve long-term endurance performance (lasting 90 min or more) and delay fatigue up to 30 to 60min. Using a combined carbohydrate/electrolyte drink has been shown to be more ergogenic (beneficial to exercise performance) than just plain water

- In the few hours before exercise/race, consume ~400-800 ml of a very low carbohydrate/electrolyte drink (1-5% CHO) or just plain water.
- Continue consuming ~100 to 150ml of the same drink at 10-15min intervals for first ~1 - 1.5h of exercise/race.
- After ~1 - 1.5h, switch to a more concentrated (8-12%CHO) carbohydrate/ electrolyte drink (or gel ~20%CHO) and continue to consume 100-150ml every 15min.

Take Home Messages:

- It can not be emphasized enough that adequate fluid replacement, equal to what is lost in the sweat, is essential for preventing dehydration and thermal injury.

- Carbohydrate ingestion in events over 90min. has been scientifically proven to increase exercise and race performance.

- BOTH heat and fluid acclimation should be conducted during training bouts, NOT during the race: NEVER try something totally new during a race, try it out first during training.