HYPERTHERMIC FATIGUE PRECEDES A RAPID REDUCTION OF SERUM SODIUM AND CRAMPING IN AN IRONMAN TRIATHLETE

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We present two original observations. First, we document the attainment of a critically high internal body temperature in a triathlete performing in an Ironman triathlon that we believe directly influenced his ability to run fast. Second, this athlete experienced an unusually rapid reduction in blood sodium (Na+) that preceded cramping, despite presenting signs of dehydration.

The subject, a 35y old male triathlete (10 Ironman triathlons: best time 10h 14min), competed in the 2006 Western Australian Ironman triathlon, which he finished in 11h 38min and 41s (swim 1:07:03; cycle 5:25:06; run 5:06:31). Air temperature ranged from 15.6oC (8:00am) to 33.1oC (3:30pm), and averaged 26.6oC, while relative humidity ranged from 73% (8:00am) to 18.4% (3:30pm) and averaged 42%.

The athlete's blood was sampled four days before the race (PRE1), the evening of the race (PRE2), at the transitions (T1 and T2), at 21 km into the run (R21); and after the race (POST). His blood sodium (Na+) was analysed by ion-selective electrode (at PRE1, PRE2, POST) or a handheld device (iStat; at T1, T2, and R21). His core temperature (Tcore) was recorded every 10s during the race by an ingestible thermistor pill that transmitted to a receiver strapped to his waist.

At PRE1 and PRE2 the athlete's serum Na+ was 141 and 140mEq/L, respectively. During the swim his Tcore progressively increased from 37.02 to 38.62oC. During the bike leg, he rode at a consistent speed (33.5km/h average), and his Tcore averaged 38.42oC (the minimum and maximum were 38.29oC and 38.73oC, respectively). His blood Na+ at both T1 and T2 was 139mEq/L. At start of the run, his Tcore was 38.15oC. At 3:52pm (the hottest part of the day; 33.1oC), after running for 50min at an average speed of 12.4 km/h, his Tcore increased to 39.4oC. On four separate occasions in another study, the athlete was exhausted at the same Tcore when he cycled indoors in 40oC. Over the following 20min of the run, he slowed to 10.0km/h (a 25% reduction in speed) and his Tcore gradually decreased to 38.9oC. He continued to run at 10.0 km/h until he stopped to provide a blood sample at R21; his blood Na+ was 131mEq/L. Shortly after restarting the run, he experienced muscle cramps in his adductor muscles in both legs; his Tcore was 38.9oC. The cramping occurred over the following 40 minutes, during which time he alternated between resting, walking and jogging at 6 km/h, and his Tcore fell to 38.0oC. He ran the final 22 min of the race at 10 km/h, during which time his Tcore increased to 38.9oC. At the finish, his serum Na+ was 131mEq/L. From the start of the race to T2 the athlete consumed 9.25L of fluid and from T2 to the finish he consumed 6.25 L of fluid. At the finish, his body mass was 2% lower than his starting mass (75.0kg) which indicates his sweat losses were greater than 15.5L. His urine specific gravity and osmolality increased from 1.015 and 465mosm/kg to 1.025 and 619mosm/kg, indicating he finished the race slightly dehydrated.

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