Fluid ingestion during exercise increases skin blood flow independent of increases in blood volume

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The purpose of this experiment was to determine whether fluid ingestion attenuates the hyperthermia and cardiovascular drift that occurs during exercise dehydration due to increases in blood volume. In addition, forearm blood flow, which is indicative of skin blood flow, was measured to determine whether the attenuation of hyperthermia and cardiovascular drift during exercise with fluid ingestion is due to higher skin blood flow. On three different occasions, seven trained cyclists [mean age, body weight, and maximum oxygen uptake: 23 ± 3 yr, 73.9 ± 10.5 kg, and 4.75 ± 0.34 (SD) 1/min, respectively] cycled at a power output equal to 62-67% maximum oxygen uptake for 2 h in a warm environment (33°C, 50% relative humidity, wind speed 2.5 m/s). During exercise, they randomly received no fluid (NF) or a volume of a carbohydrate-electrolyte fluid replacement solution (FR) sufficient to replace 80 ± 2% of sweat loss or were intravenously infused with 5.3 ml/kg of a blood volume expander (BVX; 6% dextran in saline). The infusion of 398 ± 23 ml of BVX maintained blood volume at levels similar to that when 2,404 ± 103 ml of fluid were ingested during FR and greater than that when no fluid was ingested during the 2nd h of exercise (P < 0.05). However, BVX and NF resulted in similar esophageal and rectal temperatures, forearm blood flow, and elevations in serum osmolality and sodium concentration during 2 h of exercise. In contrast, FR resulted in lower esophageal and rectal temperatures than BVX and NF during the 2nd h of exercise (P < 0.05) apparently due to a higher skin blood flow (i.e., FBF was 17-20% higher during FR compared with NF and BVX after 105 min; P < 0.05). In addition, FR resulted in a lower serum osmolality and sodium concentration than NF and BVX during the 2nd h of exercise (P < 0.05). However, BVX did prevent the 11% decline (P < 0.05) in cardiac output during the 10- to 110-min period of exercise with NF and resulted in a 9% higher stroke volume than NF after 110 min of exercise (P < 0.05). In summary, fluid replacement reduces hyperthermia during the 2nd h of cycling by allowing a higher skin blood flow, compared with when NF is ingested during exercise, and this effect is not due to an elevation of blood volume.