



## **The Importance of Hydration During High-Heat Training and Racing**

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If you noticed the Philly International Race this year it was clear how much environmental heat and humidity affect performance. The race time was a full 30 min slower than the previous year and less than half of the field finished with many riders pulling out due to serious heat stress and dehydration. Adding to the stress is that it was the first very hot and humid day this summer, and many riders had not yet acclimatized to racing in such conditions.

Research on exercise performance and temperature clearly show the detrimental effects temperature can have. In a landmark study by Galloway and Maughn, the exercise intensity that could be maintained on a cycle ergometer for 92 minutes at 11 degrees Celsius (52 degrees F) decreased to just 51 min after cycling in a 30 degree environment (86 degrees F) (1).

During prolonged exercise in the heat, athletes can lose water at a rate of 1-2 L every hour (2-4 lbs). Think of a 2 L bottle of soda, and that's the amount of just sweat lost in 1 hour! Each pound of body weight loss corresponds to 450 mL (15 fluid ounces) of dehydration. According to Coyle, every liter of water loss will raise your heart rate for a given intensity by 8 beats per minute (2).

In order to combat this dehydration and resultant cardiovascular stress athletes need to consume an equal amount of water as lost through sweating. A 72 kg athlete (158 lb) requires about 35-70 g/h of carbohydrate and 625-1250 mL/h fluid during prolonged exertion. That's about 2.5 typical cycling water bottles full of a 6% carbohydrate solution. Athletes should have no problem drinking this amount and can typically consume 1200-1500 ml/h of fluids, however, many athletes do not drink this amount, and even in moderate temperatures, this can result in a reduction in performance due to dehydration. So for a hard 2.5 hour race an athlete needs to consume at least 7 water bottles of fluid. However, during extreme heat and humidity, especially when an athlete is not acclimatized to it, the rate of water loss can exceed 2 L/h, increasing your requirements to approximately 10 water bottles during a 2.5 hour race. That's 1 bottle every 15 minutes. At these rates it becomes a losing battle and even if you did consume that amount of fluid, chances are you would not be able to digest this amount fast enough.

So pay attention to your water loss from sweating on your training rides and get an idea of exactly how much you sweat for a given temperature. Each pound of weight loss is approximately 450 mL (15 fluid ounces) of sweat and dehydration. Then formulate a drinking strategy to replenish these losses for each hour of your event. This will give you an idea of what you require to perform at your best in the heat.

1. Coyle, Edward (1994) Fluid and carbohydrate replacement during exercise: How much and why? SSE#50, Volume 7 (1994), Number 3
2. Galloway, SDR, and R.J. Maughan (1995). Effects of ambient temperature on the capacity to perform prolonged exercise in man. *J. Physiol.*, 1995: 489: 35-36P.