

Fluid Intake During Sport

Text: PVM Nutritional Sciences

Inadequate fluid intake during training/competing may have detrimental effects on performance. If total body water levels drop below normal, body temperature may increase which can cause an elevated heart rate. Perceived rate of exertion (PER) may also increase so that fatigue is experienced earlier than usual. A decrease of as little as 5% can decrease work capacity by 30% in both endurance and high intensity sports, thus affecting performance. Fluid replacement during training should be individualized as some athletes sweat more than others, and the best way to determine replenishment rate is to measure your own sweat rate. A general guideline is to replace 500ml of water for every 0.5kg body mass lost during training (control for urine losses and fluid consumed during training).



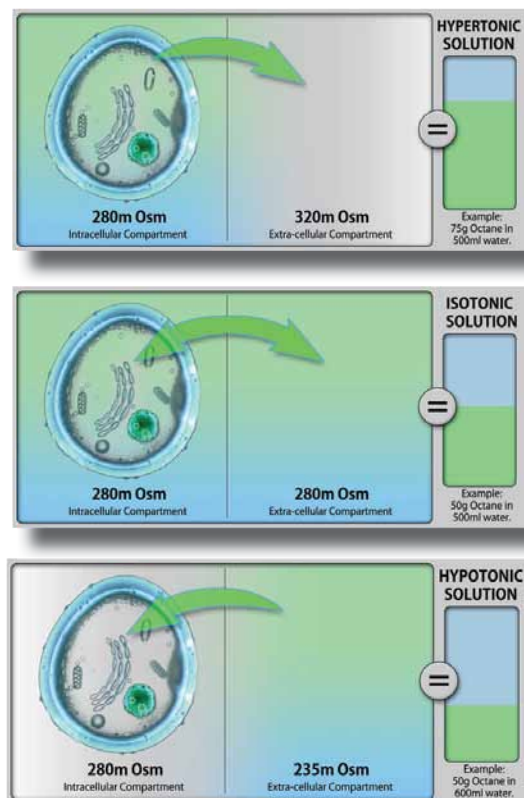
Consuming too much fluid on the other hand, may cause gastrointestinal discomfort and in extreme cases, hyponatraemia (low blood sodium levels). Symptoms of hyponatraemia are similar to dehydration and are potentially life-threatening. Hyperhydration is characterized by bloating, puffiness of hands and feet, nausea, vomiting, headache and weight gain during training/competing. Consuming sodium-containing drinks **when thirsty** minimises the risk of hyperhydration and hyponatraemia. Simultaneous consumption of carbohydrate-containing energy drinks provide additional benefits as it provides a fuel source for exercising muscle and can promote fluid absorption in the small intestine, provided the concentration is not too high (**hypertonic**). It is recommended to consume no more than 30-60g carbohydrate per hour to prevent gastro-intestinal discomfort.

Fluid is best absorbed by the body when the solution is **hypotonic or isotonic**. These two terms refer to the osmolality of the sports drink, which can be defined as the measure of the number of particles dissolved in a volume of fluid.

Normal extracellular fluid (ECF) osmolality is closely controlled between ± 285 and 305 mmol/L. This is achieved through osmotic gradients that control free water movement in either direction across the intestinal wall. Solutions containing a high concentration of particles (**hypertonic**) lead to water movement into the gastro-intestinal tract, which then promotes dehydration. A hypertonic solution has a higher osmolality (less water) and may be dangerous to consume during training or a match, especially in the heat, as it can cause diarrhoea and dehydration (See figure 1). A drink that has more or less the same osmolality as blood plasma is referred to as isotonic, and when it has a lower osmolality (more water) it is referred to as hypotonic.

Because osmolality by definition refers to the number of particles dissolved in a volume of water, both factors (water & particles) determine whether a drink is hypo-/ hyper- or isotonic. For instance, if 290 sodium millimoles are dissolved in 1 litre of water, an isotonic solution is created, but if the number is increased to 500 millimoles a hypertonic solution is created. If more water is added, another isotonic solution is created (with this approach, be careful however not to consume too much fluid during training).

Figure 1: The osmotic effect of different fluids



GUIDELINES FOR OPTIMAL HYDRATION:

- Begin training/competition well hydrated
 - Mild hyperhydration may be beneficial prior to races where intake during is limited
 - Practice individualized fluid intake protocol during training
 - Use cool beverages whenever possible
 - Start drinking early in training/competition to minimize dehydration
 - Replace fluid losses between competition sessions when fluid can't be consumed during
 - Avoid temporary weight gain caused by excessive fluid consumption during events
 - Drink according to thirst
 - Determine individual needs –
 1. Weigh yourself before and after training sessions in minimal clothing
 2. Monitor fluid consumed during training
 3. Monitor urine losses during training
 4. $\text{Sweat loss (ml)} = \text{change in body mass (g)} + \text{fluid intake (ml)} - \text{urine losses (ml)}$
 5. Divide by total hours trained to determine intake per hour
- OR** replace 500ml for every 0.5kg lost.
- Avoid body mass losses of more than 1-2% of initial value (some losses will occur anyway, especially in endurance events where fuel is metabolized)
 - Drink regularly to help maintain a high rate of gastric emptying
 - Sports drinks should be either iso/hypotonic
 - Do not consume more than 30-60g carbohydrate per hour

The PVM Energy drinks, **Octane 4.0 for endurance sports** or **Octane XTR for high intensity sports/ strength training** are isotonic/hypotonic sports drinks when prepared as follows:



Isotonic:

Mix 50g powder into 500ml water

Hypotonic:

Mix 50g powder into 600ml water

