

## **Attività fisica ed idratazione: quando l'acqua non basta**

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### **Key messages:**

- During sports training and games, thermoregulation may be a challenge when environmental conditions are hot and/or humid. In addition, limited opportunities to drink may promote dehydration and exacerbate the thermoregulatory problem.
- It is clear that general recommendations for hydration are difficult to give. In competitive and professional sports in particular, it is important to use individualized hydration strategies.
- Recent studies with professional football teams show the type of measurements which can be performed to monitor the responses and assess the individual needs of each athlete. A wide variability is found even among teammates playing under the same environmental conditions.
- There is more than water in sweat. Sodium losses tend to be high, and need to be replaced through hydration and regular diet. Sodium plays a key role in hydration.
- Because competitive athletes tend to exercise at high intensities, they use up considerable amounts of carbohydrate for fuel. Providing carbohydrate in the drinks during exercise can meet some of the needs for fuel supply.

The importance of adequate hydration during training and competition is well documented. Hydration is a relatively simple and yet very effective ergogenic aid, not only enhancing performance but also providing a safety measure to reduce the likelihood of heat illnesses.

Earlier publications give general recommendations regarding the frequency and volume of fluid intake, as well as the ideal characteristics of the fluids to be used during training and competition. However, more recent documents have adjusted those recommendations, and have emphasized the need for individualization, given that sweat rates and the electrolyte composition of sweat vary considerably from one player to another. It is also clear that the individual tolerance for large volumes of fluid intake during training and competition is highly variable.

### **Recent results obtained with professional football players.**

For about four years now, the Gatorade Sports Science Institute® has been performing sweat tests with elite athletes, quantifying each athlete's needs in order to identify individual hydration strategies. In addition to several tests with triathletes, basketball players and runners in the laboratory, several field tests have been performed with American Football and Association Football (soccer) teams. The latter have included

Real Madrid, Juventus, Ajax, Pumas, Pachuca, Corinthians, Boca Juniors, Sao Paulo Futebol Clube, Nacional de Medellín, and Manchester United.

Initial hydration status may be assessed by measuring urine osmolality or specific gravity from a urine sample prior to training. Ideally, this should be the first urine of the day, but another sample is a good measure provided the players have not been drinking large volumes of fluid recently. Such measurements have shown that invariably, some of the football players show up for training hypohydrated (i.e., a urine osmolality higher than 900 or a urine specific gravity of 1.020 or higher). These players will have a more difficult time maintaining adequate hydration during their game or practice, and will place them at a higher risk of dehydration and heat illness; performance is also more likely to be impaired when training or playing in the heat.

Table 1 shows the average and extreme values of hydration status at the end of a training session from five selected teams. Hydration status was calculated by weighing each player nude and dry before and after training, and monitoring each player's fluid intake. To do the latter, bottles were weighed before and after training, and each player was requested to drink only from his own bottles.

**Table 1.** Average and range final hydration values for five professional football teams during a typical training session.

Hydration	Team A	Team B	Team C	Team D	Team E
<b>Highest</b>	-2.45	-2.3	-2.6	-2.0	-1.88
<b>Smallest</b>	-0.71	0.24	0.24	0.5	-0.87
<b>Average</b>	-1.6	-1.1	-1.2	-0.7	-1.6

It is also possible to measure sweat electrolyte composition by placing sweat collection patches on the players and removing them after a prudent time to allow for the patches to collect a large enough sweat sample. These samples are analyzed for sodium and potassium content, the two most important electrolytes lost in sweat. Most of the football players we have evaluated show average, normal values for sweat sodium composition between 20 and 60 mEq/L. However, a few players have shown a sodium concentration closer to 70 mEq/L which, when coupled with high sweat rates, can result in considerable sodium losses which must be replaced with sports drinks and in the diet. When players use only mineral water or pure water for rehydration, they replace almost ZERO sodium. When they have used a sports drink with 18 mEq Na<sup>+</sup>/L, they have replaced closer to 20% of their sweat sodium loss.

Replacing sodium with the rehydration beverages and through the normal diet is very important for several reasons. This habit will help replace the sodium sweat losses, which can be as high as 2500 mg of sodium in a 90-minute practice. In addition, drinking fluids with sodium in them helps maintain the thirst drive and hence it improves voluntary fluid intake. It makes sense to try to hold on to the fluid people drink if they are trying to rehydrate; it is known that without sodium people will lose more fluid through the urine. It has been shown that without replacing sweat sodium losses, it is not possible to achieve fluid balance after dehydration.

## **Importance of ingesting a beverage with carbohydrate.**

Even though the initial research on hydration and carbohydrate supply focused on endurance activities such as marathons and triathlons, several scientists have expanded this to shorter, more intense sports, including stop-and-go sports like football, tennis, and basketball. An adequate supply of carbohydrate is clearly related to exercise performance, as blood glucose and muscle glycogen need to be maintained high enough to be available as fuel for the working muscles.

Carbohydrate stores in the body are relatively small, somewhere around 300 to 500 grams. When the effort is long enough, or intense enough, providing readily available carbohydrate in the drink is an effective way to improve or sustain exercise performance.

The results from football studies show the wide variability among players, hence the importance of assessing the specific needs of each player in order to develop an individual strategy for each athlete. Thirst alone is not a good mechanism for maintaining good hydration during football play and training, as some players will overhydrate while most of them will dehydrate, some of the latter to an extent which will impair their performance and place them at risk for heat illness.

In summary, athletes are advised to drink the right amount of fluid to replace sweat losses; to the extent that their efforts are long and intense, drinking a beverage with sodium and carbohydrate will give better results than drinking plain water or mineral water.

### **References:**

- American College of Sports Medicine. (1996). ACSM Position Stand on Exercise and Fluid Replacement. Med Sci Sports Exerc, 28(1), i-vii.
- Aragón-Vargas LF, Maughan RJ, Rivera-Brown A, Meyer F, Murray R, de Barros TL, García PR, Sarmiento JM, Arroyo F, Javornik R, Matsudo VKR, Salazar W, & Lentini N. (1999). Actividad Física en el Calor: Termorregulación e Hidratación en América Latina. Resúmenes del VII Simposio de Actualización en Ciencias del Ejercicio Rosario, Argentina: Biosystem Servicio Educativo.
- Coyle EF (2004). Fluid and fuel intake during exercise. J Sports Sci 22(1): 39-55.
- Shirreffs SM, Aragón-Vargas LF, Chamorro M, Maughan RJ, Serratos L, & Zachwieja JJ. (2005). The Sweating Response of Elite Professional Soccer Players to Training in the Heat. Int. J. Sports Med.,26:90-95.