

HYDRATION STRATEGIES FOR FOOTBALL

– Written by Ron Maughan and Susan Shirreffs, UK

KEY MESSAGE

Maintaining adequate hydration is important for performance. Fluid intake before, during (where appropriate) and after exercise is important, especially in hot climates. When sweat losses are high, foods and drinks consumed must contain sufficient water and salt to replace these losses.

Players know that training and match play are much harder in hot weather than cool. High humidity is also a concern and endurance performance generally falls as humidity levels increase. High levels of fitness help players cope better with heat but performance is still impaired.

Many different factors contribute to the increased fatigue that is experienced when exercising in difficult environments. When players work hard, they sweat. In a typical training session or in a game on a hot day, sweat losses may reach 3 L, though losses of

1 to 2 L are more typical. With many football players undertaking two training sessions a day in pre-season, such high sweat losses must be replaced on a daily basis. Along with water, various salts, especially sodium, will also be lost. Some players may lose 10 to 15 g of salt in their sweat in a single day, while others will lose very little, even at high sweat rates. On a cold day though, some players will lose very little sweat. Every player's hydration needs are therefore different and will vary with the intensity of training and games and with the weather over the season. Just as general training and competition strategies should be tailored for individual players in accordance with their unique needs and preferences, so too should their drinking and eating choices during training and match play. Players, coaches and trainers should 'fine tune' these recommendations to identify their own winning formula.

It is important that support staff recognise that two levels of strategy are required. The first is the team strategy that sets out general principles that will apply to all players and will take account of whether a game is at home or away, an early or late kick off, and all the other factors that will affect the drinking requirements and



each player needs a personal strategy that takes account of individual needs





behaviours. At the second level each player needs a personal strategy that takes account of individual needs.

HOW MUCH AND WHEN TO DRINK?

Players should limit dehydration during training and matches by drinking water or a sports drink. Obvious opportunities to drink during a match include warm-up, during the last minute preparations before kick-off and at half time. During training, the coach or manager should organise drink breaks according to the weather and intensity of the session. At the final of the 2008 Olympic football competition in Beijing, the weather was hot and humid. Because of these conditions, the rules of the competition was relaxed and the referee was allowed to referee to stop play for 2 minutes at the halfway point of each half of the game. This short break allowed players to take extra drinks. Having established the precedent, similar breaks might be useful in the extreme playing conditions that are sometimes encountered in the Gulf region.

Training allows opportunities for players to get a feel for their own individual sweat rates and fluid needs so that drinking practices can be adjusted according to their individual needs (Table 1). It is not necessary for players to drink enough to match sweat loss, but the amount of dehydration should normally be limited to a loss of less than

about 2% of body weight (i.e. a reduction in body weight of 1.0 kg for 50 kg person, 1.5 kg for a 75 kg person and 2 kg for a 100 kg person).

The negative effects of dehydration on high-intensity performance are greater in warm environments, so drinking practices in these conditions should be upgraded to reduce the overall fluid deficit. This may include drinking at the side line when

match play is interrupted or having extra drink breaks during training sessions. In cooler conditions it may not be necessary to drink at all.

There should never be a need to drink more than sweat loss so that weight is gained during exercise. This will not help performance and is likely to cause gut discomfort; players who feel uncomfortable will not be focused on the game. It is often

HOW TO ESTIMATE SWEATING RATE

- 1 Measure body weight (kg) both before and after at least 1 hour of exercise under conditions similar to a match or hard training session.
- 2 Measure body weight wearing minimal clothing and while barefooted. Towel dry after exercise and obtain body weight as soon as is practical after exercise (e.g. less than 10 minutes).
- 3 Note volume of fluid consumed during exercise (litres).
Sweat loss (litres) = body weight before exercise (kg) - body weight after exercise (kg) + fluid consumed during exercise (litre).
- 4 To convert to a sweat rate per hour, divide by the exercise time in minutes and multiply by 60
Note: 2.2 pounds equals 1.0 kg and converts to a volume of 1.0 l or 1,000 ml or 34 ounces of water.

Table 1: How to estimate sweating rate.



High carbohydrate strategies have been shown to enhance performance in players in mobile positions



stated that the best advice is simply to drink when thirsty but the evidence for this advice is not entirely convincing.

WHEN DO YOU NEED MORE THAN WATER?

Depletion of muscle glycogen stores can be an issue for football players in games played at a high tempo, especially for players in mobile positions or with a running game style. High carbohydrate strategies – fuelling up in the days and hours before the game and consuming extra carbohydrate during the match – have been shown to enhance performance in such players.

Better intake of fluid and fuel during a game may not only keep players running further and faster in the second half of a match, but it can also help to maintain skills and judgement when players would otherwise become fatigued. Games are often won and lost in the last minutes of the match and fatigued players are at increased risk of injury.

The use of commercial sports drinks with a carbohydrate content of about 4 to 8% (4 to 8 g/100 ml) allows carbohydrate and fluid needs to be met simultaneously in most events. The intake of carbohydrate that is generally associated with performance benefits is ~20 to 60 g per hour, though higher intakes may help if players can tolerate this. If higher amounts of carbohydrate are taken, it seems wise to use a drink containing a mixture of different carbohydrate sources (glucose, fructose, sucrose, maltodextrins) as the independent transporters of the different carbohydrates allow faster absorption in the small intestine.

Sodium should be included in fluids consumed during exercise lasting longer than 1 to 2 hours or by individuals during any event that stimulates high salt losses. You can recognise ‘salty sweaters’ by the salt rings on their clothes at the end of a hard session on a hot day. It is possible to collect sweat samples and analyse the salt content in the laboratory, but such a level of precision is not normally necessary. There is some evidence that players who lose a lot of salt may be more prone to muscle cramps. Adding a little extra salt to food and drinks and using the higher sodium version of sports drinks may reduce the risk of cramping for these players, but probably does not benefit other players. Many players may be tempted to restrict salt intake if they have a family history of hypertension, but this is not helpful for players who lose a lot of salt in their sweat.

Drinks are probably best taken cool or even cold. This generally improves palatability and also helps players feel more refreshed. Cold drinks can also provide a cooling effect: if a large volume is taken, this may be sufficient to cause a small reduction in body core temperature, helping players cope better in hot weather. Keeping drinks cool can be a logistical challenge, but the benefits probably repay the effort of organising a coolbox or similar facility to ensure that drinks remain cold throughout the game.

Caffeine is present in many commonly available drinks (tea, coffee, cola etc) and sports foods (e.g. gels, some sports drinks) and can enhance endurance during prolonged exercise. This benefit can be

obtained with the relatively small doses of caffeine that are commonly consumed by people of various cultures (e.g. about 2 to 3 mg/kg bodyweight, which is the amount found in 1 to 2 cups of brewed coffee or 750 to 1500 ml of a cola beverage). There is often a concern that the diuretic action of caffeine will increase the risk of dehydration, so players are sometimes told to avoid all caffeine-containing drinks. This is probably not wise and may do more harm than good. At the doses that are effective in improving performance, the diuretic action of caffeine is small, especially in those used to consuming caffeinated drinks. The withdrawal symptoms that may follow acute withdrawal are probably more harmful.

DRINKING BEFORE TRAINING OR GAMES

Many players are in a dehydrated state when they turn up for training and even for games. There are probably many reasons for this, but failure to allow time for breakfast before morning training is probably the most common reason. Players should eat breakfast: carbohydrate will replenish the liver glycogen stores and help maintain blood glucose. Fluids will ensure good hydration. Players who report for training already dehydrated (based on measures of urine osmolality) tend to drink more during training and match play than those who arrive well-hydrated. The time and effort needed to take extra drinks will distract from the focus on training and could be avoided by ensuring an adequate fluid intake before arriving at the training ground or stadium. In very hot weather, training and games

may be scheduled for early or late in the day to avoid excessive heat: this has some advantages, but players may need to make extra efforts to make sure they are well-hydrated at the start of the activity.

REHYDRATION AFTER EXERCISE

Recovery after exercise is part of the preparation for the next exercise session, and replacement of sweat losses is an essential part of this process. Both water and salts lost in sweat must be replaced. Players should aim to drink about 1.2 to 1.5 L of fluid for each kg of weight lost in training or matches. Drinks should contain sodium (the main salt lost in sweat) if no food is eaten at this time, but most meals will contain adequate amounts of salt. Sports drinks that contain electrolytes can be helpful, but many foods can also supply the salt that is needed. A little extra salt may be added to meals when sweat losses are high, but salt tablets are seldom or never necessary and should be used with caution.

CONCLUSION

It is hard to measure individual performance in football, so it is hard to produce convincing evidence that any nutrition or hydration intervention will be beneficial in a competitive situation. Nevertheless, there is sufficient evidence to warrant attention to hydration, especially when the weather is hot and even more so when the humidity is also high. Players will benefit from a personalised hydration plan but will need professional help to develop an effective strategy.



Further reading

1. Maughan RJ. Alcohol and football. In: Maughan RJ, ed. *Nutrition and football*. London: Routledge 2007. p. 127-140.
2. Shirreffs SM, Maughan RJ. Water and salt balance in young male football players in training during the holy month of Ramadan. *J Sports Sci* 2008; 26:547-54.
3. Kurdak SS, Shirreffs SM, Maughan RJ, Ozgüven KT, Zeren C, Korkmaz S et al. Hydration and sweating responses to hot-weather football competition. *Scand J Med Sci Sport* 2010; 20:133-139.
4. Grantham J, Cheung SS, Connes P, Febbraio MA, Gaoua N, González-Alonso J et al. Current knowledge on playing football in hot environments. *Scand J Med Sci Sports* 2010; 20:161-167.

Ron Maughan B.Sc., Ph.D.
Professor of Sport and Exercise Nutrition
Susan Shirreffs B.Sc., Ph.D.
Reader in Human Physiology
Loughborough University
Loughborough, UK
Contact: R.J.Maughan@lboro.ac.uk