

Heat, Dehydration and Performance

As we move into summer, attention turns to the issue of heat and dehydration. Matches and training during this time of year often occurs in hot, humid conditions. To cope with rising temperatures, the body cools itself through sweat and evaporation. Increased sweat rates on hot days can quickly reduce the body's fluid stores, resulting in dehydration. Sweat rates decrease and body temperature rises. This leads to a whole host of problems ranging from diminished performance to severe medical conditions. Laboratory research indicates that a 2-3% loss in body weight from dehydration can affect physical performance including strength, speed and coordination. Researchers from the UK and Denmark wanted to determine if similar reductions in performance occur during actual matches. To do this, they compared results from Champions League matches played in cool and hot environments. They found that dehydration played a key role in how much fatigue was experienced by the players.



The study focused on players from two professional Scandinavian teams that were participating in the UEFA Champions League Qualifying round. The teams played three matches at home and three matches away. The matches were separated by one week and were played at approximately the same time of day. The home matches were played at a cool temperature, 12°C (54°F) whereas the away games were played under heat stress, 30°C (86°F).

Fatigue was determined by a series of five vertical jumps performed before and after each match. Each player performed these jumps with a 5 second rest between each. Height was recorded and the average of the five jumps was used as the performance marker. The jumps tests were performed only on players who played more than 85 minutes of the match. Also, the post-match test was administered within 5 minutes of the final whistle.

As expected, sweat rates were almost two-fold greater during the matches played in the heat. As a result, players lost slightly more than 3% of their body weight, compared to 1.7 % when playing in a cool environment.

Average jump height prior to the matches was 40.3 cm (15.9 in). Following matches played at the cool temperature, jump height did not decline significantly, less than 1 cm. However, after matches played in the hot climate, jump height was reduced by 6% or by 2.4 cm (1 in). That is, greater fatigue after playing in the heat.

The greater amount of fatigue was linked to the degree of dehydration. Some of the players who were the most dehydrated and lost 4-6% of their body weight experienced a decrease in performance of more than 10%.

The researchers conclude that heat and dehydration during a competitive match contributed to the development of fatigue. Without proper hydration, high intense activities, such as sprints, jumps, and shots are likely to be compromised, especially during the later stages of the match. On the other hand, staying hydrated during the match could mean less fatigue.

The problem of dehydration *during* a match may also be compounded by the player's pre-match hydration routine. Several studies find that youth players often arrive at training and matches in a *hypohydrated* state. That is, they are not considered to be dehydrated but their body fluid levels are lower than recommended. Because they are hypohydrated to begin with, the risks of dehydration and diminished performance increase. Thus, a key pre-match strategy is to drink plenty of fluids the day preceding and during the hours leading up to kick-off. Also, during the match, take in fluids whenever possible during breaks in play and between periods.

This past Saturday (May 26), a League 1 playoff match was held in London. The high temperature was 26°C (79°F). The match ended after two overtime periods and 11 rounds of penalty kicks. Huddersfield won over Sheffield United and will be promoted next season. Interestingly, after 120 minutes of play in a warm environment, the first 10 players missed 6 penalty shots. Could this have been a result of dehydration-induced fatigue? Can dehydration change a brilliant shot into a poor effort? Those are difficult questions to answer definitively. However, when promotion hinges on the tiniest improvements in accuracy or pace, being dehydrated could change the outcome of a match and a season. A less fatigued player may be successful at the critical time.

Finally, it is important to remember that while dehydration can affect performance, the more critical issue is heat related illness. Dehydration can lead to serious medical complications ranging from mild discomfort to heat stroke. These symptoms can start to appear with as little as a 3% loss in body weight (as occurred in this study). Thus, any player who is suspected of being dehydrated should be removed from play and provided professional medical attention immediately.

The bottom line is, keep dehydration at bay by drinking plenty of fluids before and during play. Also, drink after the match. Staying hydrated can improve performance and avoid health problems.

Reference:

Mohr M, Krstrup P (2012) Heat stress impairs repeated jump ability after competitive elite soccer games, *Journal of Strength and Conditioning Research* doi: 10.1519/JSC.0b013e31825c3266