

Fluid-Electrolyte Balance Associated With Tennis Match Play in a Hot Environment

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INTRODUCTION

- On court observations and past research has shown us that many amateur and professional tennis players are not able to perform optimally under hot and/or humid conditions due to a number of factors including heat illness, heat stroke, impaired endurance capacity, and changes in players' fluid-electrolyte balance.
- Water (or fluid) is not only essential for tasks such as proper organ functioning and functioning of the senses, but is also responsible for regulating one's body temperature.
- Electrolytes (e.g., sodium, calcium, and potassium) also play a vital role in keeping the active body running smoothly by facilitating proper muscle and nerve functioning and aiding in fluid-balance maintenance.
- Studies that have investigated fluid-electrolyte balance in tennis have done so under limited conditions, only observing changes in the fluid-electrolyte concentrations at moderately high temperatures (73-81 °F; 23-27 °C) during one competitive or simulated match.
- This study set out to mimic a more extreme playing environment (in terms of temperature) over a longer period of time (similar to standard tournament play).

PURPOSE

To determine:

- If significant body water and electrolyte losses would occur during play in a hot environment
- If hydration and plasma sodium deficits would occur without changes to players' diet.



SAMPLE

20 participants (12 males, 8 females) from 2 Division I Universities participated in this study.

- Mean Age: males (20.5 years), females (20.3 years)
- Mean Height: males (180.0 cm), females (166.8 cm)
- Mean Weight: males (73.8 kg), females (60.3 kg)
- The players who participated in this study were selected because they fit the criteria needed for fitness and acclimatization to the playing environment.

METHOD

- For 3 days (temperatures ranging from 81 to 93 °F), the players participated in a simulated round robin tournament, with 2 singles and 1 doubles match per day.
- After the last match of each day, the athletes' off-court food (sodium and potassium were assessed) and fluid intake was recorded and collected.
- To test for fluid and electrolyte level changes, the players had blood and urine samples collected, the sweat on their tennis attire was monitored, their changes in body weight were calculated, and they completed a perceived thirst survey after their last match of each day.

RESULTS

Midday Singles Matches

The following observations were made during the singles matches over the course of the 72 hour observation period:

- Male players had a greater average sweat-rate than female players and had more variation in the sweat-rates between players.
- Thirst is probably not a timely or sufficient gauge of a player's level of dehydration because the reported thirst levels of the athletes did not match their actual fluid loss.
- The quantities of fluid lost in this sample were relatively small. This may have been due to the fact that the players were aware that their fluid intake was being monitored and because water was readily available at the simulated matches.
- It appeared that the electrolytes (sodium and potassium) lost during competition were compensated for by the natural diet of the players.



RESULTS (cont.)

Daily Changes

Fluids

Body water measurements observed from blood tests generally reflected little or no change in hydration status.

- Plasma body water changes from pre- to post-play varied greatly among the individual athletes.
- Changes in hydration status ranged from a slight increase (which may reflect a more hydrated state) to little or to no change in plasma volume.
- The minor or nonexistent changes in plasma volume could be due to the natural tendency of the fluids within the body's cells to move outward into the plasma because of the physical demands placed on the players'.
- Body water status observed from urine tests indicated slight decreases in hydration from pre- to post-play each day.
- Players were not well hydrated at the start of each day of competition and the fluid the athletes drank during matches did not fully compensate for the sweat lost throughout the day.
- Also, players did not appear to be replacing lost fluid from the previous day's activities during their off-time.

Electrolytes

In general, the players maintained an electrolyte balance throughout the study period.

- Even though sodium levels remained normal throughout the study period, the lowest level of plasma sodium was observed on the 4th day.
 - This decrease was most likely due to the multi-day competition demands for which the body could no longer fully replace the sodium loss with normal daily food intake.
- Potassium levels were also maintained within a normal range throughout the study period.

RECOMMENDATIONS

Fluid replacement and maintenance should be primary concerns for your players regardless of the climate conditions of the competition environment. Practicing and competing in hot and humid environments makes these practices even more essential.

Fluid Intake Recommendations

- Past recommendations are most likely insufficient (only capable of replacing about 50% of fluid lost) for play in hot conditions in which players lose a significant amount of body water through sweat.
- However, if a player attempts to replace all of the fluid lost during a match, he or she may experience stomach discomfort during competition.
- Most athletes' bodies will not be able to absorb more than 10 ounces every 10 minutes (or 10 mouthfuls of fluid every 10 minutes).
- Remember, every player is an individual. Some may be able to consume more fluid during a competition than others without experiencing any discomfort.
- Be sure to have your athletes make a habit of regularly consuming either cold water or carbohydrate-electrolyte based drinks during practice to help them become more acclimated to drinking while being active.

Fluid Type Recommendations

- To increase the likelihood that your players are consuming the essential quantities of fluid, have cold and sweet beverages available. The more tasty the beverage, the more likely the athletes will be prone to drink it.
- Re-hydration using cold water is a useful strategy for regulating body temperature, however, carbohydrate and electrolyte based drinks may be just as effective with the additional advantage of providing athletes with energy for competition.

Electrolyte Recommendations

- Electrolyte supplementation during competition is only recommended if the player is experiencing a deficit or is playing for an extended bout of time (e.g., several rounds of a tournament in one day).
- You may want to have your players increase sodium in their regular diets after two to three days of tennis play in hot or humid conditions if they plan on continuing play for another day.
- If dietary changes are not made to replace lost sodium due to use and sweat, players may develop on-court problems such as heat-related muscle cramps.

CONCLUSION

The authors concluded that "this select group of well-trained and heat acclimatized athletes generally maintained overall fluid-electrolyte balance in response to playing multiple tennis matches on three successive days in a hot environment." Even so, it was suggested that players may still benefit from a carbohydrate based, electrolyte replacement drink (as opposed to plain water) during and after play, especially for matches that are longer than two hours in duration.