Intravenous versus Oral Rehydration: Which is best for your athletes?

IV vs. Oral

The practice of using intravenous (IV) fluids to rehydrate athletes appears to be fairly common, whether it's in the NFL, collegiate football[1], at a marathon or after a triathlon. There are unquestioned medical benefits for providing an IV to a dehydrated athlete who is semi- or unconscious or who can not tolerate oral fluids. The prevailing notions among many sports health professionals are that an IV:

- Is more effective than oral rehydration in rehydrating a dehydrated athlete.
- Will provide a greater performance edge (over rehydrating orally) for an athlete between two bouts of exercise, such as the first and second halves of a football game or in between multiple daily workouts.

Many are surprised to learn that fluid taken orally has comparable physiological benefits compared to fluid given via IV. Of particular interest are studies that show oral rehydration may lead to lower body temperature[2] and improved athletic performance[2].

When you consider these advantages against the disadvantages associated with using an IV (i.e., treatment is invasive, requires trained medical staff, must be given off the field, increases risk of infection and bruising), an oral rehydration protocol is usually a more effective hydration approach.

Research Findings

To compare the response to IV and oral rehydration, researchers at the University of Connecticut conducted two studies summarized below.

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Study 1: Halftime Scenario[2-4]

In this experiment, researchers compared rehydration methods when rapid fluid replacement is needed, as is often the case during halftime in a football or soccer game.

Subjects were first dehydrated by -4% of their body mass by exercise in the heat before a fluid-replacement protocol was administered:

1. Fifty percent of fluid loss replaced over 20 minutes by ingestion.
2. Fifty percent of fluid loss replaced over 20 minutes by IV (normal saline).
3. No fluid replaced.

Immediately following the 20-minute rehydration period, the subjects cycled at 70 percent VO_2max until they exhausted. The ambient room temperature was set at 98.6ºF and the relative humidity was 50%.

The researchers found that during exercise:

- Plasma volume and osmality, skin blood flow, stroke volume, cardiac output and stress hormone response were similar for IV and oral rehydration.
- Skin and rectal temperatures were lower with oral replacement than in the IV trial.
- Thirst and ratings of perceived exertion were lower in the oral trial than in the IV trial.
- Performance for the group receiving oral fluids tended to be better than the group receiving the IV, but did not reach statistical significance.
- Subjects who were partially rehydrated (in both the oral and IV treatments) experienced greatly enhanced physiological responses and performance for nearly all variables as compared to subjects who were not rehydrated.

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Study 2: Two-a-Days Scenario[5-7]
In this study, researchers compared multiple rehydration techniques over a longer rehydration period, a scenario not unlike what happens with multiple daily workouts.

Subjects were first dehydrated to -4% body mass before rehydration:

1. Seventy-five percent of fluid loss replaced orally over 45 minutes.
2. Seventy-five percent of fluid loss replaced via IV (1/2 normal saline) over 45 minutes.
3. Seventy-five percent of fluid loss replaced via IV (normal saline) over 45 minutes.
4. No fluid replacement.

Seventy-five minutes passed before the subjects walked at 50 percent VO_2max for 90 minutes with the ambient room temperature set at 98.6ºF.

The results indicated that:

- Rectal temperature, skin temperature, sweat rate, performance and stress hormone responses were similar in the IV and oral groups.
- Interestingly, thirst and rating of perceived exertion were lower in the oral trial than in the IV trials.

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Why Oral Rehydration is Better
These results demonstrate no discernable advantage for IV compared to oral rehydration. The data also suggest that oral fluid replacement may provide a performance advantage, reduce the subjective perception of thirst and make exercise feel easier (lower RPE). Additional research is needed to further characterize these differences.

Perhaps the greatest advantage of an effective oral rehydration protocol is that it encourages athletes to take an active role in rehydrating themselves, thus avoiding psychological dependence on intravenous fluids. Keeping the athlete responsible for his or her fluid replacement needs is the best approach to reduce the risks associated with dehydration.

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Identifying Individual Fluid Needs: A Self-Testing Program for Optimal Hydration
Athletes have long been encouraged to drink adequate volumes of fluid to prevent dehydration. The goal of drinking during exercise is to consume enough fluid to minimize loss of body weight.

That volume is different for each athlete, however, as sweat rates can differ widely among athletes and excessive drinking may lead to hyponatremia, a fluid/electrolyte disorder that occurs when the sodium level in blood drops below normal.

Here are two simple methods for identifying individual fluid replacement needs:

Method # 1

1. Record nude body weight prior to a typical training session.
2. Drink normally during the training session.
3. Record nude body weight after the training session.
4. Weight loss of greater than 1% of body weight indicates inadequate drinking; drink more in future practices. Weight gain indicates excessive drinking; cut back in future practices.

Method # 2

1. Make sure athletes are properly hydrated before workouts by having them check their urine, which should look more like lemonade than apple juice.
2. Record pre-exercise body weights by weighing athletes naked or in minimal clothing.
3. Have them participate in a normal practice for one hour and keep track of how much fluid they drink during that time. Be certain they do not urinate during the practice.
4. Weigh them again on the same scale. (They may urinate after weighing).
5. Calculate their fluid needs using the following formula:

A. Enter your body weight from Step 3 in Kilograms*
(To convert from pounds to kilograms, divide pounds by 2.2) _____
B. Enter your body weight from Step 7 in Kilograms*
(To convert from pounds to kilograms, divide pounds by 2.2) – _____
C. Subtract B from A = _____
x 1000
D. Convert your total in C to grams by multiplying by 1000 = _____
E. Enter the amount of fluid you consumed during the run in milliliters + _____
(To convert from ounces to milliliters, multiply ounces by 30)
F. Add E to D = _____

This final figure is the number of milliliters (ml) that you need to consume per hour to remain well-hydrated. If you want to convert milliliters back to ounces, simply divide by 30.

It is important to determine sweat rates and drinking habits on a regular basis (e.g., every few weeks) because changes in fitness and acclimation influence both sweat rates and drinking behavior.

In many situations, athletes can benefit from favoring a carbohydrate-electrolyte beverage over water because research has shown that a properly formulated sports drink will provide greater hydration and performance benefits.

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References

[1]King et al. Use of Intravenous rehydration in American Football. *Journal of Athletic Training*. 38(2):S-30, 2003.
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