LUCOZADE SPORT SCIENCE:
FLUID NEEDS FOR SPORT

KEY POINTS

- If the fluid lost as sweat is not replaced dehydration occurs. As a result, the consumption of fluid is critical to the safe and effective functioning of the body during exercise.

- The variability in sweat rate between individuals, sports and environmental conditions emphasise that there is no single 'one size fits all' recommendation for fluid intake.

- Dehydration, by as little as 2% of body mass (1.4 kg for a 70 kg individual), can reduce both mental (concentration, focus, reaction time) and physical (endurance) performance.

- The primary aim of most individuals is to begin exercise in a hydrated state with normal plasma electrolyte (principally sodium) levels.

- Fluid replacement during exercise should approximate sweat and urine losses, or at the very least maintain hydration at less than a 2% body mass reduction.

- To ensure rapid and complete recovery from dehydration, individuals are recommended to consume 1.5 L of fluid for each kilogram of body mass lost as sweat.

INTRODUCTION

Exercise results in the production of heat within the body, which unless removed, can lead to significant increases in body (core and skin) temperature. Sweating is the body's primary mechanism of heat loss. However, if the fluid lost as sweat is not replaced, then dehydration occurs and body temperature will increase anyway. As a result, the consumption of fluid is critical to the safe and effective functioning of the body during exercise.

Sweating is remarkably individual, being influenced by exercise intensity, duration, environmental conditions and the type of clothing/equipment worn. Furthermore, individual characteristics such as body weight, genetics, heat acclimatisation, and fitness will influence sweat rate for any given activity. Consequently, the variability in sweat rate between individuals emphasises that there is no single 'one size fits all' recommendation for fluid intake.

EFFECTS OF DEHYDRATION

Dehydration is associated with a thickening of the blood due to a decrease in plasma volume. This increases the strain placed upon the cardiovascular system to maintain a high blood flow to the exercising muscles. The associated increase in heart rate, decrease in cardiac output (the amount of blood pumped out by the heart each minute) and increase in muscle glycogen utilisation is what contributes to a decrease in exercise performance.

Dehydration, by as little as 2% of body mass (1.4 kg for a 70 kg individual), can reduce both mental (concentration, focus, reaction time) and physical (endurance) performance. With increasing levels of dehydration the impact on performance is more severe, although the exact point and size of the performance decrease is related to the individual,

environmental temperature and exercise task. Therefore some individual's are more or less tolerant to dehydration.

PRE-EXERCISE HYDRATION

The most important aim for any individual is to begin exercise in a hydrated state. This will normally occur if sufficient fluids are consumed with meals (2 L of fluid per day) and there is 8-12 h between training. However, this is not always the case, with many individuals beginning exercise in a dehydrated state. This is probably due to high sweat losses during exercise and/or poor habitual ('normal') consumption of fluids throughout the day. Currently, the ACSM guidelines for exercise and fluid replacement suggest;

- Slow consumption of 5-7 millilitres of fluid per kilogram of body mass (ml/kgBM) at least 4 h before exercise.

- If the individual does not produce urine, or the urine is dark or highly concentrated then more fluid should be consumed about 2 h before the event (e.g. 3-5 ml/kgBM).

- Consume fluids with sodium and/or small amounts of salted snacks or sodium containing foods to stimulate thirst and retain the consumed fluid.

- As far as possible ensure the palatability of the fluid is high to promote consumption.

FLUID INTAKE DURING EXERCISE

The aim of drinking fluid during exercise is to prevent significant dehydration and large changes in electrolyte (principally sodium) balance. How much fluid an individual needs to drink depends on individual sweat rate, exercise duration and the practical opportunities to drink. Fluid intake should match sweat and urine losses, or at the very least, maintain hydration at a body mass loss ≤ 2%. This can be calculated, and monitored, by measuring body weight changes immediately before and after exercise.

Drink larger volumes of fluid early in exercise and continue to ingest fluid throughout (little and often: ~ 150 ml every 10-15 min). Isotonic sports drinks are the preferred drinks for endurance based exercise (~ 1 h or greater).

POST-EXERCISE HYDRATION

Following exercise, individuals should replace any fluid and electrolyte losses that have occurred during exercise. The main factors affecting post-exercise hydration are the volume and composition of the fluid consumed, whilst the aggressiveness of the strategy will depend on the amount of sweat lost and/or the timing of the next exercise bout.

When rapid and complete restoration of fluid balance is necessary, plain water is not the ideal post-exercise hydration drink as it stimulates high urine flow and reduces the drive to drink. Instead consume fluids that contain sodium, the primary electrolyte lost in sweat, to help the retention of the ingested fluids, stimulate thirst and enhance the absorption of carbohydrate in the small intestine.

Consume 1.5 litres (L) of fluid for each kg of body mass lost as sweat. Consume the fluid over time as opposed to one large bolus with isotonic sports drinks popular options.

HYDRATION ASSESSMENTMENT

There are two reasons to assess hydration, 1) Determine whether an individual is dehydrated, or certainly if dehydration is occurring cumulatively over time and 2) to calculate individual sweat rate for prescriptive fluid intake strategies. The following guidelines are recommended by the ACSM.

- Measurement of body mass first thing in the morning (after voiding), in combination with a measure of urine concentration to determine changes in fluid balance over time.

- Hydrated individuals will maintain a stable nude body mass (fluctuation < 1%). Three consecutive morning nude BM measurements are needed to establish a baseline value.

- Urine specific gravity (USG) and urine osmolality (UOsmol) are quantifiable measures of hydration useful in the field environment.

- USG of < 1.020 is indicative of being hydrated. UOsmol is more variable, but values < 700 mOsmol/kg are also indicative of being hydrated.

- For those without the ability to measure urine concentration, the urine colour chart is also a suitable method, albeit subjective in nature.

- Record pre-exercise and post-exercise nude body weight, and correct for fluid intake and urine loss, to calculate individual sweat rate (1 litre = 1 kilogram).

- …for example, if you started exercise 70 kg, finished exercise 69 kg and drank 500 ml of fluid during 1 h of exercise (with no urine losses), then sweat rate is 1.5 L/h.

RECOMMENDED READING

- Coyle, E.F. (2004). Fluid and fuel intake during exercise. Journal of Sports Sciences, 22, 39-55.

- Sawka, M.N., Burke, L.M., Eichner, E.R., Maughan, R.J., Montain, S.J. and Stachenfield, N.S. (2007). American College of Sports Medicine position stand: Exercise and Fluid Replacement. Medicine and Science in Sports and Exercise, 39, 377-390.

- Shirreffs, S.M., Armstrong, L.E. and Cheuvront, S.N. (2004). Fluid and electrolyte needs for preparation and recovery from training and competition. Journal of Sports Sciences, 22, 57-63.