Functions of Water

1. Regulates body temperature
2. Transports nutrients (e.g. glucose, electrolytes, oxygen, iron)
3. Carries waste products away (e.g. creatinine, urea)

Fluid is Lost Through

1. Respiration
2. Perspiration
3. Evaporation from skin
4. Urination

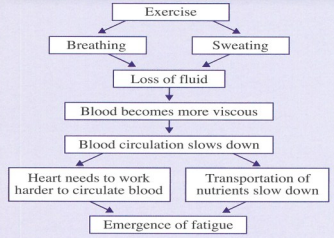
Fluid is Gained By

1. Fluids (e.g. water, fruit juice, sports drink, soup, milk etc.)
2. Foods (e.g. fruits, vegetables, congee etc.)
3. Metabolism of nutrients (e.g. carbohydrate, fat, protein) releases water

Symptoms of Dehydration

1. Fatigue
2. Flushed skin
3. Shrivelled skin
4. Light headedness
5. Dark coloured urine
6. Delirium
7. Cramps
8. Heat stroke

The Relationship between Dehydration & Fatigue



Fluid loss of >2% body weight can negatively affect aerobic exercise performance especially in warm hot weather. Dehydration can result in increased body core temperature, increased heart rate, increased glycogen utilization which can further cause fatigue. Excess fluid loss may also degrade cognitive performance which is important for sports requiring skill, concentration and agility.

Guidelines to Fluid Supplementation

According to ACSM guideline in 2007:

1. Before exercise

Drink 5-7mL of fluids per kg body weight at least four hours before exercise. If there is no urine production or urine output is minimal, drink 3-5mL of fluids about 2 hours before exercise.

2. During exercise

The goal of drinking during exercise is to prevent excessive dehydration (>2% body weight loss from water deficit). Drinking sports beverages can help to sustain fluids/electrolytes balance and enhance performance for long duration and high-intensity exercise. Fluid replacement depends upon individual variability and environmental conditions. These factors include body weight, weather condition, duration and intensity of exercise and type of sports. For example, sports require the wearing of protective clothing such as fencing and American football, exercises undertaking in hot humid weather condition and outdoor activities will increase sweating rates of athletes. It is important for athletes to establish individualized fluid replacement strategies.

3. After exercise

Fluids and electrolytes loss should be fully replenished post-exercise events. The change in body weight after exercise can determine sweat rates and is useful for establishing effective individualized fluid replacement strategies. For rapid and complete recovery, it is recommended to drink 1.5L (6 cups) of fluid for each kilogram (2 pounds) of body weight lost.

** Weight loss after exercise is primarily due to loss of body fluids and not fat because you need to burn 3500 kcal for losing a pound of fat.*

Fluid Loss Assessment

Hydration status assessment

Measure	Cut-Off for Good Hydration Status
Total body water	<2%
Plasma osmolality	<290 mOsmol
Urine specific gravity	<1.020 g/mL
Urine osmolality	<700 mOsmol
Body weight	<1%

Among different assessment methods, body weight measurement is the simplest tool for athletes to assess fluid balance. Body weight changes before and after exercise reflects the amount of fluid loss from sweat. Athletes can monitor their hydration status by using body weight measurement.

Example:
Pre-exercise body weight 80kg
Post-exercise body weight 78kg
Body weight loss -2kg

According to post exercise fluid replacement guideline:
1.5L fluid / kg body weight loss x 2kg
→ Replace 3L fluid

Avoid Over-Hydration

Although adequate fluid replacement is important to maintain normal physiological function, excessive fluid replacement may not be beneficial. Drinking large amount of hypotonic fluid after exercise will reduce plasma concentration and result in hyponatremia. It affects the replenishment of body fluid and stimulates urine production. Athletes may think that adequate fluid has been taken, but they are actually more dehydrated. Athletes are suggested to drink sodium-containing fluid after exercise which can help to restore plasma volume.

Choosing a Suitable Fluid Replacement Drink

- for exercise which lasts 90 minutes or less, replacing with water or sports drink (contains carbohydrate, electrolytes and fluid).
- for exercise which lasts longer than 90 minutes, sports drink is a better choice for the following reasons:
  1. Carbohydrates to supply energy.
  2. Commercial sports drinks available in the market normally contain 6-8 % carbohydrates, and are absorbed as quickly as water.
  3. Contains sodium, potassium and other electrolytes to replace loss from sweating and maintain fluid and electrolyte balance.

Beverages to Avoid During Exercise

1. Alcoholic beverages (e.g. beer, wine, cocktail)
   * Alcohol is diuretic which promotes fluid loss.
2. Carbonated beverages (e.g. soft drinks, soda water)
   * Carbonation leads to sensation of stomach fullness and burping which decrease the desire to drink.

Dehydration can have detrimental effects, it may lead to heat stroke and even death!

References:
1. Sawka, M.N., L. Burke, E. Eichner, et al. American College of Sports Medicine position stand: Exercise and fluid replacement. Medicine and Science in sports and Exercise. 39:377-390, 2007.

The above information is provided by the Sport Nutrition Unit of the Athlete and Scientific Services Division. All information is for reference only.

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生命之泉－水
WATER - THE FOUNTAIN OF LIFE

HONG KONG SPORTS INSTITUTE 香港體育學院

水的功用

1. 調節體溫
2. 輸送營養素（如：糖份、電解質、氧份、鐵質）
3. 帶走血液中的廢物（如：肌酸酐、尿素）

水份流失的途徑

1. 呼吸
2. 流汗
3. 從皮膚蒸發
4. 小便

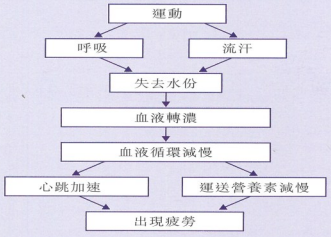
水份的來源

1. 飲品（如：水、果汁、運動飲品、湯、奶等）
2. 食物（如：水果、蔬菜、粥等）
3. 營養素（如：碳水化合物、脂肪、蛋白質）的代謝會產生水份

脫水（失去大量水份）的症狀

1. 疲勞
2. 面紅
3. 皮膚摺皺
4. 頭暈
5. 小便呈深黃色
6. 出現幻覺
7. 抽筋
8. 中暑

身體失去水份與疲勞的關係



若脫水超出體重的2%即會損害帶氧運動的能力，特別是在高溫環境下進行的運動。脫水會令體溫上升、心跳加快、增加肌醣使用量而引起疲勞。大量的水份流失亦可能影響認知能力，所以對一些講求技巧、專注及靈敏性的運動亦十分重要。

水份補充的指引

根據美國運動醫學學會2007年的指引：

1. 運動前

運動前四小時，飲用相等於每公斤體重5-7毫升的飲品。若運動前兩小時沒有排尿或排尿量少，須再飲用相等於每公斤體重3-5毫升的飲品。

2. 運動中

運動過程中應攝取足夠水份，以避免過度脫水即體重下降超過2%）。

若運動時間較長和強度較高，飲用運動飲品能保持體內水份及電解質平衡，提高運動表現。水份補充須根據個人差異及環境狀況而定。個人體重、天氣狀況、訓練時間、劇烈程度和不同的運動項目都能影響水份流失。例如：需要穿著保護服飾的運動（如劍擊、美式足球）、在炎熱及戶外環境下進行的運動會增加水份流失。運動員應該在訓練期間建立個人化的水份補充策略。

3. 運動後

運動後須補充於運動期間所流失的水份和電解質。運動後的體重改變，可估計水份之流失量，以建立有效的個人化水份補充策略。每1公斤（2磅）的體重下降須補充1.5公升（6杯）的水份以加速恢復期的時間。

* 運動後體重下降是流失水份所致，並不是脂肪消失了，因為燃燒1磅脂肪需要消耗3500千卡。

如何評估水份流失?

評估水份流失的方法

測量方法	水份平衡指標
身體總水量	<2%
血漿滲透壓	<290 mOsmol
尿液比重	<1.020 g/mL
尿液滲透壓	<700 mOsmol
體重	<1%

對運動員而言，最簡單的方法是量度運動前後的體重改變。短時間內的體重差異是由於汗液流失所致，運動員可藉此自行評估水份的流失量並作適當的補充。

示例：運動前體重80公斤
運動後體重78公斤
體重差異-2公斤

根據運動後水份補充指引：
1.5公升/公斤體重下降
x 2公斤體重差異
→ 補充3公升水份

避免過度補充水份

儘管水份的適當補充對於維持人體生理機能非常重要，但並不是補充越多的水份越好。運動後飲用大量清水，會更加稀釋血液造成低血鈉症，引致血溶量的恢復受影響，身體同時會製造大量小便來減低血液的稀釋度。運動員會誤以為已經補充足夠水份，但事實上脫水的情況更為嚴重。運動員應在運動後飲用含鈉質的飲品作補充，幫助血溶量的復原。

擇適合你的水份補充飲品

1. 少於90分鐘的運動時間，可以清水或運動飲品（含糖、電解質及水份）補充。
2. 超過90分鐘的運動時間，最好用運動飲品，因為：
   a) 糖份供給能量。
   b) 市面上有售的運動飲品一般含6-8%糖份，吸收速度如吸收水一樣快。
   c) 含鈉、鉀等有助補充汗液流失的電解質及維持體內電解質與水份的平衡。

運動時應該避免的飲品

1. 含酒精的飲品（如：啤酒、餐酒、雞尾酒）
   * 酒精有利尿作用，使身體延遲恢復水平衡。
2. 含氣的飲品（如：汽水、梳打水）
   * 飲後會令人有飽及胃氣脹滿的感覺，從而減低飲用水份的份量。

脫水的後果嚴重，能致中暑甚至死亡！

參考資料：
1. Sawka, M.N., L. Burke, E. Eichner, et al. American College of Sports Medicine position stand: Exercise and fluid replacement. Medicine and Science in sports and Exercise. 39:377-390, 2007.

以上資料由運動員及科研事務科轄下的運動營養部提供，只供參考。

歡迎轉載以上資料，惟事先須得本院許可；轉載時亦須鳴謝本院。

如有查詢，請致電 26816277與運動科學部聯絡。

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