

Exercise and Fluid Needs

Key Facts

- ※ Evaporation of sweat helps to cool the body down during exercise. Apart from water, sweat contains sodium, potassium and minerals.
- ※ Drinking enough fluid is necessary to replace fluid lost in sweat during exercise. Failure to do so can lead to dehydration. On the other hand, overdrinking can lower the sodium level in the blood and cause hyponatraemia.
- ※ Care should be taken before, during and after exercise in determining hydration status and replacement of fluids and electrolytes (such as sodium) to reduce the risk of dehydration and excessive electrolyte loss.

General Hydration Tips

- ※ Fluid needs are likely to be low for exercises that are of intermittent or short duration (<1 hour) and of low intensity.
- ※ Fluid needs vary depending on the person, type, duration and intensity of exercises and the environmental conditions. Healthy adults can use the following guidelines as a reference and develop a customised fluid replacement plan according to personal needs. Consult your family doctor to get more detailed information on what your fluid requirement may be. Young children, elders, and those with chronic medical illnesses (such as hypertension, heart disease, diabetes or renal disease) should seek family doctor's advice in deciding their exercise and fluid plans.
- ※ **Before exercise**
The goal of pre-hydration is to optimise hydration status.
 - * Drink 480 - 600 ml of fluid slowly at least 4 hours before exercise.
 - * Water is usually the best choice.
- ※ **During exercise**
The goal of drinking during exercise is to maintain fluid balance and prevent dehydration.
 - * Drink 90 - 240 ml of water every 15 to 20 minutes when exercising for less than 60 minutes. Water is usually the best choice.
 - * Drink 90 - 240 ml of sport drinks containing sodium every 15 to 20 minutes when exercising longer than 60 minutes or exercising in hot and humid environments, engaging in endurance exercise or high-intensity exercise (such as marathon running and competitive cycling or tennis), or wearing a lot of protective gears (such as in hockey).
 - * Do not drink more than 1 L of water per hour during exercise.
- ※ **After exercise**
The goal of drinking after exercise is to fully replace both water and sodium loss in sweat.
 - * Compare the body weight before and after exercise to estimate any weight deficit (i.e. body weight in kg before exercise minus body weight in kg after exercise) that is likely from water loss.
 - * Fluids (and electrolytes) should be consumed over time rather than drunk in large boluses.

Exercise and Fluid Needs

Staying hydrated is essential for human survival, as an adult body constitutes 60% of water on average, with a range from about 45% to 75%. As a percentage, babies and children have more water than adults.^{1,2} In fact, every system in our body depends on water to maintain its function. Water is essential for transportation of nutrients, maintenance of blood circulation and pressure, regulation and maintenance of body temperature (through sweating and respiration), facilitation of digestion, lubrication of joints and body tissues, formation of hormones and neurotransmitters, cushion organs, and elimination of waste products (mainly through urination).^{1,3} While the amount of water needed each day is highly variable depending upon individuals' age, sex, health status, activity level and weather conditions etc, healthy adults in general are advised to drink 6 to 8 glasses (about 240 ml each) of water or fluids (such as milk or clear soup) every day. Some people would need extra amounts of water to replace imminent fluid loss, such as physically active people, those working or playing in hot or dry environments, and individuals having fever, vomiting or diarrhoea. Yet, an earlier survey of about 2 100 community-dwelling people aged 18-64 in 2007 found that around one-third (32.3%) of the respondents reported consumption of less than 6 glasses of fluids on average a day (Table 1).⁴

Sweat Loss during Exercise and Risk of Dehydration

Evaporation of sweat helps to cool the body down during exercise. Apart from water, sweat contains substantial amounts of sodium (average concentration around 1g/L in sweat), modest amounts of potassium and small amounts of minerals.⁵ A variety of factors during exercises can influence sweat rate, these include the duration and intensity of exercise, the environmental conditions (e.g. temperature and humidity), the type of clothing/equipment worn and individual characteristics (e.g. health status and body weight). As a result, there is a large range in sweat rates (0.5 L to 2.0 L per hour) and total sweat losses of individuals during exercises.²

Hydration remains equally important regardless of the degree of exercise. For many individuals who participate in exercises that are intermittent or of short duration (< 1 hour), of lower intensity and in cooler environments, fluid needs are likely to be low.⁶ However, individuals who take part in competitive sports or exercise of vigorous intensity or for prolonged hours in warm-hot environments particularly, hydration is a specific concern as dehydration can affect their performance and safety.⁶ Dehydration with >2% of body weight loss from water deficit² (i.e. 1.4 kg for a 70 kg adult) can degrade aerobic exercise and impair cognitive performance, especially in warm-hot weather.

Table 1: Patterns of fluid consumption among community-dwelling people aged 18-64 by average number of glasses of fluids drunk per day and sex, 2007

Average number of glasses of fluids drunk per day	Male	Female	Overall
Less than 6	32.8%	31.9%	32.3%
6-8	48.3%	53.6%	51.1%
More than 8	18.4%	14.3%	16.3%
Unknown/Missing/Outliers	0.4%	0.1%	0.3%

Note: Column totals may not be equal to 100% due to rounding.

Source: Behavioural Risk Factor Survey April 2007.

Dehydration also increases the risk for heat exhaustion and heat stroke. Common symptoms of dehydration in adults are listed in Box 1.

Box 1: Common symptoms of dehydration (in adults)⁷

- Thirst
- Dizziness
- Tiredness
- Nausea
- Headache
- Chills
- Muscle cramps

Among profuse sweaters, high sodium losses are a common cause of exercise-related muscle cramps. Of note, prolonged and heavy sweating with failure to replace sodium or excessive water intake can result in low level of plasma sodium (hyponatraemia).⁵ While mild hyponatraemia can cause nonspecific symptoms like headache, nausea and vomiting, severe form can lead to incoordination, seizure, confusion, coma, respiratory arrest, and death.^{6,8} Thus, care should be taken before, during and after exercise in determining hydration status and replacement of fluid and electrolyte to reduce the risk of dehydration and excessive electrolyte lost.

Hydration Assessment

Thirst is not a good indicator of hydration status because genuine thirst develops only after dehydration is present. Compared to adults, use of sensation of thirst to assess hydration status has limited application to children and elderly persons as they are less sensitive to thirst.⁶

There are two simple methods that can help individuals determine their hydration status: body weight measurements before and after exercise and urine colour test.^{2,3,6}

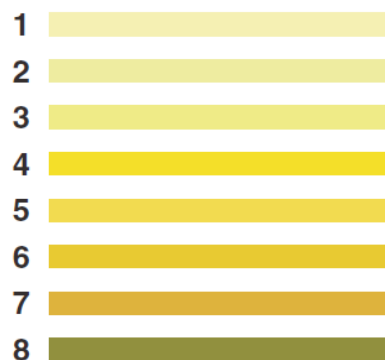
Body weight measurements before and after exercise⁹

- * Weigh in minimal clothing and while barefooted as close to the start of exercise as possible. Ideally, empty the bladder before weighing.
- * Weigh in minimal clothing and while barefooted at the end of exercise again. Ensure towel off any excess sweat from the body prior to weighing.
- * Compare the body weight before and after exercise to estimate hydration status. Any weight deficit (i.e. body weight in kg before exercise minus body weight in kg after exercise) is likely from water loss. As generally assumed, the acute loss of 1 g of body weight is equivalent to the loss of 1 ml of water (0.5 kg is equivalent to about 500 ml).⁶

Urine colour test

- * Urine colour can be compared against a urine colour chart (Box 2). A large amount of light-colour or pale yellow urine is a sign of well-hydration. Passing dark yellow urine means dehydration and the darker the colour indicates the greater degree of dehydration.³

Box 2: Urine colour chart³



Hydration for Exercise

Because there is wide variability in sweat losses and hydration levels of individuals who perform different types, intensities and duration of exercises, precise fluid recommendations are difficult to determine. To sustain appropriate hydration, however, healthy adults can use the following guidelines as a reference and develop a customised fluid replacement plan in accordance to individual needs, level of exertion and environmental conditions.^{2,3,5,7,8} Beware of overdrinking, i.e. fluid consumption greater than sweat losses, as it can also lower the sodium level in the blood and cause hyponatraemia or even water intoxication. Consult your family doctor to get more detailed information on what your fluid requirement may be. Young children, elders, and those with chronic medical illnesses (such as hypertension, heart failure, diabetes or renal disease), they should seek family doctor's advice prior to deciding their exercise and fluid plans.

Before exercise

The goal of pre-hydration is to optimise hydration status. It should be initiated at least several hours before the exercise to enable fluid absorption and allow urine output to return toward normal levels after exercise.²

- * Drink 480 - 600 ml of fluid slowly at least 4 hours before exercise.³
- * Water is usually the best choice.⁷

During exercise

The goal of drinking during exercise is to maintain fluid balance and prevent dehydration. As opportunities allow, individuals should periodically drink during exercise. The amount and rate of fluid replacement depends upon the individual sweat rate and exercise duration. The measurement of pre- and post-exercise body weights is useful for determining sweat rates and customised fluid replacement programmes.²

- * Drink 90 - 240 ml of water every 15 to 20 minutes when exercising for less than 60 minutes. Water is usually the best choice.³

- * Drink 90 - 240 ml of sport drinks (Box 3) containing sodium every 15 to 20 minutes when exercising longer than 60 minutes. Follow the same when exercising in other special circumstances, such as exercising in hot and humid environments, engaging in endurance exercise or high-intensity exercise (such as marathon running and competitive cycling or tennis), or wearing a lot of protective gears (such as in hockey).^{3,7,10}
- * But do not drink more than 1 L of water per hour during exercise.³ Avoid carbonated soft drinks or energy drinks that contain a lot of sugar and caffeine as these fluids may cause stomach upset.⁷

After exercise

The goal of drinking after exercise is to fully replace both water and sodium loss in sweat.

- * Obtain body weight and check urine to estimate fluid loss.²
- * If time permits, consumption of normal meals and snacks containing sufficient sodium with an adequate volume of plain water will help to restore hydration status.²

Box 3: What you should know about sport drinks⁷:

Sport drinks provide:

- Fluids to replace your loss and cool down your body
- Carbohydrates for quick energy
- Sodium and potassium which are lost in sweat

What to look for in a sport drink:

- Non-carbonated
- Sodium: 300 to 700 mg/L (or at least 70mg/250ml)
- Carbohydrates: 40 to 80 g/L (equivalent to 4 to 8 g/100 ml) from different sources such as glucose, sucrose or fructose)

A good sport drink does not need to include added amino acids, oxygen, caffeine or herbal ingredients. Check the nutrition labels before buying.

- * If rapid recovery from dehydration is needed, drink about 1.5 L of water or sport drinks for every kg of body weight lost. The additional volume is needed to compensate for the increased urine production accompanying the rapid consumption of large volumes of fluid. Therefore, when possible, fluids (and electrolytes) should be consumed over time rather than drunk in large boluses.^{2,9}
- * Avoid alcohol as it can act as diuretics and increase urine output, thereby delaying full rehydration and physical recovery from exercise.^{11,12}

Other Precautions to Minimise the Risk of Exercise-induced Injuries

Other than maintaining sufficient hydration for the protection of health, individuals should also take precautions to minimise the risk of exercise-induced injuries.

- * Do not exercise with an empty stomach. Eat something light (such as toast with jam or skimmed milk) to give you some stamina. Do not exercise immediately after a full meal because this will affect digestion.
- * Wear appropriate clothing based on the weather conditions and the time of day. Choose a pair of shoes that fits your feet properly. Put on appropriate gear for the activity, such as helmets for cycling.
- * Beware of the weather and environmental conditions. Avoid exercise outdoor when the air pollution levels are high. Adopt proper sun protection measures, such as slop on sunscreen and cover up with appropriate loose-fitting clothing and a broad-brimmed hat.
- * Always warm up before doing exercise and cool down afterwards to lower the risk of strains and sprains.
- * Choose exercises that suit your physical capability. Take appropriate breaks during the

activity to avoid over-exertion. Stop exercising if there is dizziness, chest pain, shortness of breath, nausea or vomiting, severe muscle or joint pain, and consult your family doctor promptly for diagnosis and treatment.

- * Consult your family doctor for a medical check before starting any vigorous exercise programme if you are overweight or obese, or have chronic medical conditions (such as hypertension, heart disease, diabetes mellitus, asthma or arthritis), or have not been exercising for a long time.

For more information on exercise and health, please visit the website of the Central Health Education Unit of the Department of Health at www.cheu.gov.hk, or call the 24-hour pre-recorded health education hotline at 2833 0111.

References

1. The Water in You. Reston, Virginia: U.S. Geological Survey; 2014.
2. Sawka MN, Burke LM, Eichner ER, Maughan RJ, Montain SJ, Stachenfeld NS. American College of Sports Medicine position stand. Exercise and fluid replacement. *Med Sci Sports Exerc.* Feb 2007;39(2):377-390.
3. Selecting and Effectively Using Hydration for Fitness. Indianapolis, IN: American College of Sports Medicine; 2011.
4. Behavioural Risk Factor Survey April 2007. Hong Kong SAR: Department of Health.
5. Rodriguez NR, DiMarco NM, Langley S. Position of the American Dietetic Association, Dietitians of Canada, and the American College of Sports Medicine: Nutrition and athletic performance. *J Am Diet Assoc.* Mar 2009;109(3):509-527.
6. Kenefick RW, Cheuvront SN. Hydration for recreational sport and physical activity. *Nutr Rev.* Nov 2012;70 Suppl 2:S137-142.
7. Sports Hydration. Ontario: Dietitians of Canada; 2010.
8. O'Connor RE. Exercise-induced hyponatremia: causes, risks, prevention, and management. *Cleve Clin J Med.* Sep 2006;73 Suppl 3:S13-18.
9. Fluids in Sport. South Melbourne: Sport Dietitians Australia; 2009.
10. Hydration and Exercise. London: Natural Hydration Council; 2013.
11. Shirreffs SM, Maughan RJ. Restoration of fluid balance after exercise-induced dehydration: effects of alcohol consumption. *J Appl Physiol* (1985). Oct 1997;83(4):1152-1158.
12. Zoorob R, Parrish ME, O'Hara H, Kalliny M. Sports nutrition needs: before, during, and after exercise. *Prim Care.* Jun 2013; 40(2):475-486.

Sport For All Day
全民運動日
3.8.2014

日日運動半個鐘
跳繩強身好輕鬆
Stay active
Rope skipping keeps you fit

免費康樂活動
Free Recreation Programmes

免費使用康樂設施
Free Use of Leisure Facilities

查詢 Enquiries 2414 5555 www.lcsd.gov.hk

康樂及文化事務署
Leisure and Cultural Services Department

衛生署
Department of Health

康樂及文化事務署
Leisure and Cultural Services Department

康樂及文化事務署
Leisure and Cultural Services Department

康樂及文化事務署
Leisure and Cultural Services Department

康樂及文化事務署
Leisure and Cultural Services Department

康樂及文化事務署
Leisure and Cultural Services Department

To know more about the Sport for All Day 2014, visit <http://www.lcsd.gov.hk/specials/sfad2014/en/index.php>.

Non-Communicable Diseases (NCD) WATCH is dedicated to promote public's awareness of and disseminate health information about non-communicable diseases and related issues, and the importance of their prevention and control. It is also an indication of our commitments in responsive risk communication and to address the growing non-communicable disease threats to the health of our community. The Editorial Board welcomes your views and comments. Please send all comments and/or questions to so_dp3@dh.gov.hk.

Editor-in-Chief

Dr Regina CHING

Members

- | | |
|-----------------|-------------------|
| Dr Thomas CHUNG | Dr Eddy NG |
| Dr Cecilia FAN | Dr Karen TSO |
| Dr Anne FUNG | Ms Faith WAN |
| Dr Winnie LAU | Dr Lilian WAN |
| Dr Ruby LEE | Dr Monica WONG |
| Mr YH LEE | Dr Priscilla WONG |