

Hydration guidance

Water requirements for working and exercising in the heat

1. Commanders **should** be aware that either inadequate or excess water intake is associated with sub-optimal mental, physiological and physical function. Adequate hydration is therefore essential to support maximal heat loss via efficient sweating and to prevent the development of illness. Additional information on hydration can be obtained from the Defence Nutrition Advisory Service (DNAS).^{1,2,3}
2. **High risk activity** (generally considered to be activities that have a high work rate, are in heavier clothing, for a longer duration, or in hotter climates). Promoting drinking before, during and after a high-risk activity is one of the most important preventive measures that a commander can influence. Thirst alone may be a poor indicator of fluid requirements during exercise/ arduous physical work. However, adequate provision of liquids to support drinking behaviour (as desired) is advised following these guidelines:
 - a. A minimum of 500 ml of water (half a standard water bottle) 2 hours before a high-risk task.
 - b. A further 300 ml (third of a standard water bottle) over the 15 minutes before the task.
 - c. Refer to the recommended intake rate in Table 1 – Maximum Recommended Fluid Intake for WBGT vs Work Rate during the task.
 - d. One litre of water (full water bottle) over 1-2 hours after the activity.
3. **Prolonged exposure to heat.** If personnel are exposed to heat continually (e.g. on an overseas deployment or during a hard, physical training course), they **should** be advised to drink water regularly during the day to ensure their urine always remains pale yellow in colour. For planning requirements, commanders **should** be aware that daily water requirements can increase from 2-4 litres to as much as 8-12 litres in extreme conditions, depending on physical activity levels.
4. Table 1 provides the number of litres (a standard water bottle contains 1 litre) required per hour during work at various WBGTs using the exercise intensities from the work rest guidance tables. The required water consumption volume/ rate **should** be staggered over the hour period, as many individuals find large volumes of water difficult to tolerate in one intake. Hydration bladders (e.g. Cambelbaks™) can aid the regular intake of water during an activity. However, the cautionary notes at paragraph 5 (Danger of over-hydration) **should** be noted.

¹ Defence Nutrition Advisory Service (DNAS) Fact Sheet SEN4, Hydration for Performance.

² Defence Nutrition Advisory Service (DNAS) Fact Sheet SEN8, Energy Drinks.

³ Defence Nutrition Advisory Service (DNAS) Fact Sheet SEN10, Nutrition in Hot Environments.

Table 1: Maximum Recommended Fluid Intake (Litres per hour) for Wet Bulb Globe Temperature (WBGT) vs. Work Rate.^{4,5}

WBGT index (°C WBGT)	Work Rate (as detailed in Annex C Work/ Rest Tables)			
	Easy Work	Moderate	Hard Work	Very Hard Work
20.0 to 24.9	0.25	0.5	0.75	1.0
25.0 to 26.9	0.5	0.75	1.0	1.25
27.0 to 29.9	0.5	1.0	1.25	1.25
30.0 to 33.9	0.75	1.0	1.25	1.25
34 or more	1.0	1.25	1.25	1.25

Notes: a. These are maximum fluid provision recommendations and drinking **should** reflect the amount of activity undertaken.

b. Electrolyte beverages **should** be consumed rather than plain water if drinking 1.25 L/hour for up to 4 hours to mitigate hyponatraemia.⁶

5. **Danger of over-hydration.** Whilst rehydration is an important preventative measure, over-hydration does not further reduce the risk of heat illness. Over-hydration can cause potentially severe medical consequences (e.g. nausea, vomiting, headache, irritability and loss of consciousness) and can be fatal. Only in exceptional circumstances should the daily fluid intake exceed 12 litres. The hourly rate of fluid intake should not normally exceed 1.25 litres per hour. Commanders are responsible for monitoring the fluid intake of their personnel. This may require systematic checks, particularly where hydration bladders or similar fluid delivery systems are used. Personnel who are urinating more often than normal may be over-hydrated.

6. **Salt intake.** Complete restoration of a fluid volume deficit requires electrolyte (mainly sodium) replacement in food and beverages. To prevent salt depletion in environments where the required work rate is associated with prolonged or persistent sweating, acclimatised personnel who maintain an adequate food intake throughout the day will consume sufficient salt (in food) to replenish body sweat losses.⁷ It is therefore important that personnel do not miss meals.

⁴ Montain SJ et al. (1999). Fluid replacement recommendations for training in hot weather. *Mil. Med.* 164: 502-508.

⁵ Kolka MA et al. (2003). Effectiveness of revised fluid replacement guidelines for military training in hot weather. *Av. Space Environ. Med.* 74: 242-246.

⁶ Low blood sodium, which can be related to excessive water intake.

⁷ Acclimatised personnel have more efficient sweating mechanisms than those not acclimatised, whereby the sweat glands produce more sweat and retain more salt. Ongoing fluid requirements increase with acclimatisation and salt requirements decrease.

Providing additional salt sachets with meals, especially during the early acclimatisation phase of a deployment or training activity in the heat, will enable personnel to salt their food 'to taste' (note: salt deficiency is typically indicated by a desire for saltier food).⁸ Salt tablets or medical rehydration solutions (which are designed to replace gastrointestinal losses) are not recommended without close medical supervision. Excessive salt intake may cause gastrointestinal discomfort and nausea, increase water requirements, and may be hazardous rather than beneficial.

7. **Electrolyte drinks.** When conditions do not permit the eating of meals or snacks, and/ or personnel experience heat anorexia (i.e. reduced appetite), it is recommended that electrolyte beverages are provided for replacing fluid and salt. This would be especially important during periods of prolonged work without additional food. Care should be taken to use electrolyte beverages that do not contain substances which could adversely affect Compulsory Drug Testing outcomes.⁹ Where electrolyte beverages are not available, salt **should** be added to plain water. One sachet (1 g) of salt to one litre of water or 2 x 1 g sachets to 1.5 litres of water is sufficient with a flavouring if desired. However, where fluid intake is likely to remain high for many hours, supplemental electrolytes contained in beverages will not adequately replenish all losses. In such circumstances, it is advised that additional provision of salty snacks or food is considered.

8. **Drinks to avoid.** Sports drinks may assist recovery after prolonged physical activity or replenish energy where access to food is limited. But such beverages **should** not replace water as the preferred option for all other circumstances. Caffeinated/ high-energy/ stimulant drinks are not recommended for rehydration. These drinks, and some commercially available dietary supplements, may lead to further dehydration and **should** be avoided. Electrolyte beverages containing sugars encourage the growth of harmful bacteria in water bottles or hydration bladders, which **should** be thoroughly cleaned at least daily.

⁸ Personnel who are not acclimatised have less efficient sweating mechanisms. Water and salt must be replaced.

⁹ Refer to JSP 835, Part 1 Alcohol and substance misuse and testing.