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Nutrient Reference Values for Australia and New Zealand
Including Recommended Dietary Intakes

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WATER

BACKGROUND

Water is defined as an essential nutrient because it is required in amounts that exceed the body's ability to produce it. All biochemical reactions occur in water. It fills the spaces in and between cells and helps form structures of large molecules such as protein and glycogen. Water is also required for digestion, absorption, transportation, dissolving nutrients, elimination of waste products and thermoregulation (Kleiner 1999).

Water accounts for 50–80% of body weight, depending on lean body mass. On average, men have a higher lean body mass than women and higher percentage of body mass as water than in women. The relative mass of water decreases in both men and women with age. Human requirements for water are related to metabolic needs and are highly variable. They depend to some extent on individual metabolism.

Solid foods contribute approximately 20% of total water intake or about 700–800 mL (NNS 1995). The remainder of the dietary intake comes from free water and/or other fluids (NHMRC 2003). An additional 250 mL or so of water is also made available to the body from metabolism (water of oxidation). The body must retain a minimal amount to maintain a tolerable solute load for the kidneys. Excluding perspiration, the normal turnover of water is approximately 4% of total body weight in adults. In a 70 kg adult, this is equivalent to 2,500–3,000 mL/day.

Water losses from lungs and skin (insensible losses) are responsible for 50% of the total water turnover. They are sensitive to environmental conditions and can be increased at high temperatures, high altitude and low humidity. During summer, when heat stress may be high, water depletion can lead to heat exhaustion, loss of consciousness and heat stroke (Cheung et al 1998, Hubbard & Armstrong 1988). Unfit, overweight, older people may be especially at risk, particularly if they are subjected to strenuous exercise. Infants and dependent children may also be at risk if not offered sufficient fluids. The remainder of the losses are from urine and stools.

Dehydration of as little as 2% loss of body weight results in impaired physiological responses and performance. The reported health effects of chronic mild dehydration and poor fluid intake include increased risk of kidney stones (Borghi et al 1996, Hughes & Norman 1992, Iguchi et al 1990, Embon et al 1990), urinary tract cancers (Bitterman et al 1991, Wilkens et al 1996, Michaud et al1999), colon cancer (Shannon et al 1996) and mitral valve prolapse (Lax et al 1992) as well as diminished physical and mental performance (Armstrong et al 1985, Brooks & Fahey 1984, Brouns et al 1992, Cheung et al 1998, Kristel-Boneh et al 1988, Torranin et al 1979, Sawka & Pandolf 1990).

Oral health may also be affected by fluid consumption. Apart from the beneficial effects of fluoride added to tap water in many communities in Australia and New Zealand, fluid intake can affect saliva production. Saliva, which is primarily water, is essential for maintenance of oral health. Decreased body water has been associated with salivary dysfunction, especially in older adults. However, one investigation (Ship & Fischer 1997) found that decreased salivary gland function was associated with dehydration, independent of age.

Several factors increase the possibility of chronic, mild dehydration, including a poor thirst mechanism (Sagawa et al 1992, Sansevero 1997), dissatisfaction with the taste of water (Meyer et al 1994, Weissman 1997), consumption of common diuretics such as caffeine (Meyer et al 1994) and alcohol, participation in exercise (Convertino et al 1996) and environmental conditions (Sagawa et al 1992).

Kidney function can decline as part of the normal ageing process with decrease in kidney mass, declines in renal blood flow and glomerular filtration rate, distal renal tubular diluting capacity, renal concentrating capacity, sodium conservation and renal response to vasopressin. This decline in kidney function together with hormonal changes and factors such as decreased thirst perception, medication, cognitive changes, limited mobility and increased use of diuretics and laxatives make older adults a group of particular concern (NHMRC 1999). Numerous studies have shown diminished thirst sensations in the elderly. Despite the fact that these changes may be normal adaptations of the ageing process, the outcomes of dehydration in the elderly are serious and range from constipation to cognitive impairment, functional decline, falls or stroke.

Hydration status, assessed by plasma or serum osmolality is the indicator of choice to assess water requirements. However, the body's needs vary widely according to environmental conditions, physical activity and individual metabolism. The body can also compensate in the short term for over or under-hydration, so it is difficult to establish an EAR experimentally. There is no single level of water intake that would ensure adequate hydration and optimal health for half of all the apparently healthy people in the population, in all environmental conditions. Thus an AI has been established based on median population intakes in Australia.

RECOMMENDATIONS BY LIFE STAGE AND GENDER

Infants	**AI**	**Water**
0–6 months	**0.7 L/day (from breast milk or formula)**	
7–12 months	**0.8 L/day (from breast milk, formula, food, plain water and other beverages, including 0.6 L as fluids)**	

***Rationale*:** Infants exclusively fed breast milk do not require supplemental water. Breast milk is 87% water. The AI for 0–6 months was calculated by multiplying the average intake of breast milk (0.78 L/day) by the average amount of water in breast milk (0.87 L/L), and rounding. For infants of 7–12 months, the breast milk intake is assumed to be 600 mL/day. This would supply 0.52 L water/day. An amount of 0.32 L/day is added for water from complementary foods as estimated from the US CSFII data (FNB:IOM 2004) to give a total of 0.84 L/day rounded to 0.8 L/day.

Children & adolescents	**AI**		**Water**
	Total water (Food and fluids)	**Fluids (Including plain water, milk and other drinks)**	
All			
1–3 yr	**1.4 L/day**	**1.0 L/day (about 4 cups)**	
4–8 yr	**1.6 L/day**	**1.2 L/day (about 5 cups)**	
Boys			
9–13 yr	**2.2 L/day**	**1.6 L/day (about 6 cups)**	
14–18 yr	**2.7 L/day**	**1.9 L/day (about 7–8 cups)**	
Girls			
9–13 yr	**1.9 L/day**	**1.4 L/day (about 5–6 cups)**	
14–18 yr	**2.2 L/day**	**1.6 L/day (about 6 cups)**	

***Rationale*:** The National Nutrition Survey of Australia, 1995 (ABS 1998) showed that for children and adolescents, some 70% of water intake came from beverages and milk, leaving 30% from foods. Children living in extremely hot climates may require higher than AI amounts to remain hydrated, especially if they are highly active.

Adults	**AI**		**Water**
	Total water (Food and fluids)	**Fluids (Including plain water, milk and other drinks)**	
Men			
19–30 yr	**3.4 L/day**	**2.6 L/day (about 10 cups)**	
31–50 yr	**3.4 L/day**	**2.6 L/day (about 10 cups)**	
51–70 yr	**3.4 L/day**	**2.6 L/day (about 10 cups)**	
>70 yr	**3.4 L/day**	**2.6 L/day (about 10 cups)**	
Women			
19–30 yr	**2.8 L/day**	**2.1 L/day (about 8 cups)**	
31–50 yr	**2.8 L/day**	**2.1 L/day (about 8 cups)**	
51–70 yr	**2.8 L/day**	**2.1 L/day (about 8 cups)**	
>70 yr	**2.8 L/day**	**2.1 L/day (about 8 cups)**	

***Rationale*:** Intakes for adults were based on the median intake from the National Nutrition Survey of Australia, 1995 (ABS 1998). The NNS showed that for adults, some 75% of water intake came from beverages (alcoholic and non-alcoholic) and milk, leaving 25% from foods. The AIs for men and women were set at the level of the highest median intake from any of the four age categories for each gender. Adults living and or working in extremely hot climates may require higher than AI amounts to remain hydrated, especially if they are very active.

Pregnancy	**AI**		**Water**
	Total water (Food and fluids)	**Fluids (Including plain water, milk and other drinks)**	
14–18 yr	**2.4 L/day**	**1.8 L/day (about 7 cups)**	
19–30 yr	**3.1 L/day**	**2.3 L/day (about 9 cups)**	
31–50 yr	**3.1 L/day**	**2.3 L/day (about 9 cups)**	

***Rationale*:** A pregnant woman has slightly increased water requirements because of expanding extracellular fluid space, the needs of the fetus and the amniotic fluid. While there are differences in plasma osmolality in pregnancy (Davison et al 1981, 1984, Lindheimer & Davison 1995) the differences are short-term and do not seem to relate to poor hydration. Thus, an AI was set based on median intakes in pregnancy. As there are few data for water intake in pregnancy in Australia and New Zealand, data were sourced from US surveys (FNB:IOM 2004) that showed an increase of approximately 10% in total water consumption. Women living and/or working in extremely hot climates may require higher than AI amounts to remain hydrated, especially if they are very active.

Lactation	**AI**		**Water**
	Total water (Food and fluids)	**Fluids (Including plain water, milk and other drinks)**	
14–18 yr	**2.9 L/day**	**2.3 L/day (about 7 cups)**	
19–30 yr	**3.5 L/day**	**2.6 L/day (about 9 cups)**	
31–50 yr	**3.5 L/day**	**2.6 L/day (about 9 cups)**	

***Rationale*:** There is no evidence that renal function and hydration are different in lactation. However, a lactating woman must replace fluid lost in breast milk. Water accounts for 87% of milk and the average milk production in the first six months of lactation is 0.78 L/day (equivalent to 0.70 L water). The increased total water need is therefore some 0.70 L/day above basic needs. Women living and/or working in extremely hot climates may require higher than AI amounts to remain hydrated, especially if they are very active.

UPPER LEVEL OF INTAKE - WATER

No upper level of intake has been set.

***Rationale*:** Excess water intake can cause hyponatremia, but this is a rare occurrence in the general population. There are no data on habitual consumption resulting in specified hazards in apparently healthy people. In addition, there is a significant self-regulation of excess water consumption in healthy people in temperate climates. Thus no UL for water has been set.

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