

The following is an extract from:

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

ENDORSED BY THE NHMRC ON 9 SEPTEMBER 2005

© Commonwealth of Australia 2006

ISBN Print 1864962372
ISBN Online 1864962437

The Nutrient Reference Values (NRVs) was a joint initiative of the Australian National Health and Medical Research Council (NHMRC) and the New Zealand Ministry of Health (MoH). The NHMRC would like to thank the New Zealand MoH for allowing the use of the NRV material in the development of this website.

NHMRC publications contact:

Email: nhmrc.publications@nhmrc.gov.au
Internet: <http://www.nhmrc.gov.au>
Free Call: 1800 020 103 ext 9520

POTASSIUM

BACKGROUND

Potassium is the major cation of intracellular fluid and an almost constant component of lean body tissues. A high intracellular concentration of potassium is maintained by the Na⁺/K⁺-ATPase pump. The movements of potassium out of cells and sodium into cells changes the electrical potential during depolarisation and repolarisation of nerve and muscle cells.

Leafy green vegetables, vine fruit such as tomatoes, cucumbers, zucchini, eggplant and pumpkin, and root vegetables are particularly good sources of potassium. It is also moderately abundant in beans and peas, tree fruits such as apples, oranges and bananas, milks and yoghurts and meats. In unprocessed foods, potassium occurs mainly with bicarbonate-generators like citrate. Potassium added during processing is generally as potassium chloride. About 85% of potassium is absorbed (Holbrook et al 1984).

Most of the ingested potassium (80–90%) is excreted in urine, the rest being excreted in faeces and sweat (Holbrook et al 1984, Pietinen 1982). Potassium filtered in the glomeruli of the kidney is mostly reabsorbed. The potassium in urine results from secretion into the cortical collecting duct under control of the hormone, aldosterone. High plasma levels of potassium stimulate release of aldosterone to increase the secretion of potassium.

Potassium requirements can be affected by climate and physical activity, the use of diuretics, and the intake of other electrolytes, notably sodium. Potassium blunts the effect of sodium chloride on blood pressure, mitigating salt sensitivity and lowering urinary calcium excretion (Whelton et al 1997). Given this interrelatedness, requirement for potassium depends to some extent on dietary sodium, however, the ideal sodium:potassium intake ratio is not sufficiently established to use in setting requirements.

It has been hypothesised that high protein-low potassium diets could induce a low-grade metabolic acidosis that could induce demineralisation of bone, osteoporosis and kidney stones (Barzel 1995, Lemann et al 1999) and epidemiological and metabolic studies have supported this suggestion (Maurer et al 2003, Morris et al 2001, New et al 1997, Sebastian et al 1994, Tucker et al 1999).

Potential indicators for potassium requirements include potassium balance, serum potassium and clinical endpoints, such as the levels required to avoid hypokalemia, high blood pressure, cardiovascular disease, bone demineralisation or kidney stones. However, dose-response trials are either not available for many of these endpoints, or are insufficient to estimate average requirements.

1 mmol potassium = 39 mg potassium

RECOMMENDATIONS BY LIFE STAGE AND GENDER

<i>Infants</i>		AI	Potassium
0–6 months	400 mg/day		(10 mmol)
7–12 months	700 mg/day		(18 mmol)

Rationale: The AI for 0–6 months was calculated by multiplying the average intake of breast milk (0.78 L/day) by the average concentration of potassium (500 mg/L), and rounding. For 7–12 months, an average breast milk volume of 0.6 L/day and concentration of 500 mg/L give an intake of 300 mg/day, to which is added 440 mg/day from complementary foods as determined by the US CSFII survey (FNB:IOM 2004).

<i>Children & adolescents</i>	AI	Potassium
All		
1–3 yr	2,000 mg/day	(50 mmol)
4–8 yr	2,300 mg/day	(60 mmol)
Boys		
9–13 yr	3,000 mg/day	(76 mmol)
14–18 yr	3,600 mg/day	(92 mmol)
Girls		
9–13 yr	2,500 mg/day	(64 mmol)
14–18 yr	2,600 mg/day	(66 mmol)

Rationale: There is very little evidence about requirements in children. The recommendations are derived from the intakes from the appropriate age group data from the Australian (ABS 1998) and New Zealand (MOH 2003) National Nutrition Surveys on a population-weighted basis.

<i>Adults</i>	AI	Potassium
Men		
19–30 yr	3,800 mg/day	(100 mmol)
31–50 yr	3,800 mg/day	(100 mmol)
51–70 yr	3,800 mg/day	(100 mmol)
>70 yr	3,800 mg/day	(100 mmol)
Women		
19–30 yr	2,800 mg/day	(72 mmol)
31–50 yr	2,800 mg/day	(72 mmol)
51–70 yr	2,800 mg/day	(72 mmol)
>70 yr	2,800 mg/day	(72 mmol)

Rationale: Whilst there are some experimental data on potassium intakes in relation to blunting of salt sensitivity (Morris et al 1999b) and some supportive epidemiological evidence on renal stones (Curhan et al 1993, 1997, Hirvonen et al 1999) these were considered insufficient basis for setting an AI as the sodium blunting experiment was carried out in males only and much of the key data related to salt sensitive African American males. The AI was therefore set at the highest median intake for the various age categories of adult males and females.

<i>Pregnancy</i>	AI	Potassium
14–18 yr	2,800 mg/day	(72 mmol)
19–30 yr	2,800 mg/day	(72 mmol)
31–50 yr	2,800 mg/day	(72 mmol)

Rationale: Potassium accretion in pregnancy is small, so the AI is set at the same level as that for adult females.

Lactation		AI	Potassium
14–18 yr	3,200 mg/day		(82 mmol)
19–30 yr	3,200 mg/day		(82 mmol)
31–50 yr	3,200 mg/day		(82 mmol)

Rationale: The lactation AI is set at that for adult females plus an allowance for potassium secreted in breast milk.

UPPER LEVEL OF INTAKE - POTASSIUM

No ULs have been set for potassium from dietary sources.

For infants 0–12 months, the source of intake should be breast milk, formula and food only. For children, adolescents and adults, including pregnant and lactating women, supplements should be taken only under medical supervision.

Rationale: High potassium intakes can cause gastrointestinal discomfort and stress that may include ulceration and perforation (Lambert & Newman 1980, Leijonmarck & Raf 1985, Pietro & Davidson 1990, Sinar et al 1986). Arrhythmia can also arise from the resulting hyperkalaemia (Haddad & Strong 1975, Kallen et al 1976, Snyder et al 1975, Su et al 2001, Ray et al 1999, Wetli & Davis 1978).

However, in otherwise healthy people, there have been no reports of hyperkalaemia from acute or chronic ingestion of potassium naturally occurring in food, so a UL for foods has not been set.

Because of its well-documented potential for toxicity, supplemental potassium should only be provided under medical supervision. For infants, intake should be limited to potassium occurring in breast milk, formula and complementary foods.

REFERENCES

- Australian Bureau of Statistics: Department of Health and Aged Care; *National nutrition survey. Nutrient intakes and physical measurements. Australia, 1995*. Canberra: Australian Bureau of Statistics, 1998.
- Barzel US. The skeleton as an ion exchange system: implications for the role of acid-base imbalance in the genesis of osteoporosis. *J Bone Min Res* 1995;10:1431–6.
- Curhan GC, Willett WEC, Rimm ER, Stampfer MJ. A prospective study of dietary calcium and other nutrients and the risk of symptomatic kidney stones. *N Engl J Med* 1993;328:833–8.
- Curhan GC, Willett WC, Speizer FE, Spiegelman D, Stampfer MJ. Comparison of dietary calcium with supplemental calcium and other nutrients as factors affecting the risk of kidney stones in women. *Ann Intern Med* 1997;126:497–04.
- Food and Nutrition Board:Institute of Medicine. *Dietary Reference Intakes for water, potassium, sodium, chloride and sulfate*. Panel on the dietary reference intakes for electrolytes and water. Washington, DC: National Academy Press, 2004.
- Haddad A, Strong E. Potassium in salt substitutes. *N Engl J Med* 1975;292:1082.
- Hirvonen T, Pietinen P, Virtanen M, Albanes D, Virtamo J. Nutrient intake and use of beverages and the risk of kidney stones among male smokers. *Am J Epidemiol* 1999;150:187–94.
- Holbrook JT, Patterson KY, Bodner JE, Douglas LW, Veillon C, Kelsay JL, Mertz W, Smith JC. Sodium and potassium intake and balance in adults consuming self-selected diets. *Am J Clin Nutr* 1984;40:786–93.

- Kallen RJ, Reiger CHL, Cohen HS, Suter MA, Ong RT. Near-fatal hyperkalemia due to ingestion of salt substitute by an infant. *JAMA* 1976;235:2125–6.
- Lambert JR, Newman A. Ulceration and stricture of the oesophagus due to potassium chloride (slow release tablet) therapy. *Am J Gastroenterol* 1980;73:508–11.
- Leijonmarck CE, Raf L. Gastrointestinal lesions and potassium chloride supplements. *Lancet* 1985;1:56–7.
- Lemann J. Relationship between urinary calcium and net acid excretion as determined by dietary protein and potassium: a review. *Nephron* 1999;81:18S–25S.
- Maurer M, Reisen W, Muser J, Hulter HN, Krapf R. Neutralisation of Western diets inhibits bone resorption independently of K intake and reduces cortisol secretion in humans. *Am J Physiol Renal Physiol* 2003;284:F32–F40.
- Ministry of Health. NZ Food NZ Children. *Key results of the 2002 National Children's Nutrition Survey*. Wellington: Ministry of Health, 2003.
- Morris RC Jnr, Sebastian A, Formon A, Tanaka M, Schmidlin O. Normotensive salt-sensitivity: effects of race and dietary potassium. *Hypertension* 1999;33:18–23.
- Morris RC Jnr, Frassetto LA, Schmidlin O, Forman A, Sebastian A. Expression of osteoporosis as determined by diet-induced electrolyte and acid-base metabolism. In: Burckhardt PB, Dawson-Hughes B, Heaney RP eds, *Nutritional Aspects of Osteoporosis*. San Diego, CA: Academic Press, 2001. Pp 357–78.
- New SA, Bolton-Smith C, Grubb DA, Reid DM. Nutritional influences on bone mineral density: a cross-sectional study in postmenopausal women. *Am J Clin Nutr* 1997;65:1831–9.
- Pietinen P. Estimating sodium intake from food composition data. *Ann Nutr Metab* 1982;26:90–9.
- Pietro DA, Davidson L. Evaluation of patients' preference of two potassium chloride supplements. Slow-K and K-Dur. *Clin Ther* 1990;12:431–5.
- Ray KK, Dorman S, Watson RDS. Severe hyperkalemia due to the concomitant use of salt substitutes and ACE inhibitors in hypertension: a potentially life threatening interaction. *J Hum Hypertens* 1999;13:717–20.
- Sebastian A, Harris ST, Ottaway JH, Todd KM, Morris RC Jnr. Improved mineral balance and skeletal metabolism in postmenopausal women treated with potassium bicarbonate. *N Engl J Med* 1994;330:1776–81.
- Sinar DR, Bozynski EM, Blackshar JL. Effects of oral potassium supplements on upper gastrointestinal mucosa: a multicenter clinical comparison of three formulations and placebo. *Clin Ther* 1986;8:157–63.
- Snyder EL, Dixon T, Bresnitz E. Abuse of salt substitutes. *New Engl J Med* 1975;292:1082.
- Su M, Stork C, Ravuri S, Lavoie T, Anguish D, Nelson LS, Hoffman RS. Sustained-release potassium chloride overdose. *J Toxicol Clin Toxicol* 2001;39:641–8.
- Tucker KL, Hannan MT, Chen H, Cupples LA, Wilson PWF, Kiel DP. Potassium, magnesium and fruit and vegetable intakes are associated with greater bone mineral density in elderly men and women. *Am J Clin Nutr* 1999;69:727–36.
- Wetli CV, Davis JH. Fatal hyperkalemia from accidental overdose of potassium chloride. *JAMA* 1978;240:1339.
- Whelton PK, He J, Cutler JA, Brancati FL, Appel LJ, Follmann D, Klag MJ. Effects of oral potassium on blood pressure: meta-analysis of randomised controlled clinical trials. *JAMA* 1997;277:1624–32.