

National Heart Foundation of Australia

Position Statement



The relationships between dietary electrolytes and cardiovascular disease

This Position Statement was developed to help the public, health professionals, industry and governments to better understand the relationships between dietary electrolytes and cardiovascular disease. The strength of the evidence has meant that this statement has focused on sodium and potassium.

Findings

A number of dietary electrolytes have been associated with a rise in blood pressure (BP). Raised BP is a major, preventable risk factor for cardiovascular disease (CVD), including stroke, coronary heart disease, heart failure, peripheral vascular disease and kidney failure (Australian Institute of Health and Welfare, 2006). The risk of cardiovascular disease increases as the level of BP increases. In addition to the physiological effects resulting from variations in the intakes of electrolytes, there may be significant interactions between them that affect CVD risk. A review of the literature around dietary electrolytes, BP and CVD was therefore conducted to:

- determine whether a causal association exists between a decrease in dietary sodium intake and reduction in CVD risk, with a focus on BP and clinical end points of CVD
- determine whether a causal association exists between an increase in dietary potassium, calcium and magnesium and a reduction in CVD risk, with a focus on BP and clinical end points of CVD
- examine the evidence for each electrolyte (sodium, potassium, calcium and magnesium) in isolation and also in combination with each other and their effect on BP
- determine population-based recommendations for sodium in order to reduce BP.

Based on the scientific literature discussed in the Heart Foundation publication *Summary of evidence statement on the relationships between dietary electrolytes and cardiovascular disease*, the Heart Foundation's findings on the relationships between dietary electrolytes and CVD are¹:

¹ Criteria used to assess the evidence:

Good evidence: systematic reviews and randomised controlled trials (RCTs), consistent findings, large studies, measurement bias adequately minimised, statistically significant;

Moderate evidence: RCTs, observational studies, large studies, use of surrogate measures, limited number and type of studies, limited in quality, effect possibly due to measurement bias; and

Weak evidence: RCTs, observational studies, small individual trials, inconsistency across study findings, limited number and type of studies, limited in quality, effect possibly due to measurement bias.



The relationships between dietary electrolytes and cardiovascular disease (2006)

Sodium

Reducing dietary sodium is associated with a fall in BP in hypertensive and normotensive individuals.

This is supported by good evidence in the scientific literature to indicate that²:

- A reduction in dietary sodium of approximately 1700 mg/day (75 mmol/day) results in a fall in systolic BP of 4–5 mm Hg in hypertensive individuals (those with systolic BP \geq 140 mm Hg) and a fall in systolic BP of 2 mm Hg in normotensive individuals (those with systolic BP $<$ 120 mm Hg).
- A reduction in dietary sodium from 3200 to 2300 mg/day (140 to 100 mmol/day) results in a fall in systolic BP of 2 mm Hg in those with a mean systolic BP of 135 mm Hg (normotensive to mildly hypertensive individuals).
- A reduction in dietary sodium from 3200 to 1500 mg/day (140 to 65 mmol/day) results in a fall in systolic BP of 7 mm Hg in those with a mean systolic BP of 135 mm Hg (normotensive to mildly hypertensive individuals).

There is moderate evidence in the scientific literature to indicate that:

- High dietary sodium intake is associated with increased stroke incidence, and mortality from coronary heart disease and CVD.

Potassium

Increasing dietary potassium is associated with a fall in BP in hypertensive and normotensive individuals.

This is supported by good evidence in the scientific literature to indicate that:

- An increase in dietary potassium intake of approximately 2100 mg/day (54 mmol/day) is associated with a fall in systolic BP of 4–8 mm Hg in hypertensive individuals (those with systolic BP \geq 140 mm Hg) and a fall in systolic BP of 2 mm Hg in normotensive individuals (those with systolic BP $<$ 120 mm Hg).

There is moderate evidence in the scientific literature to indicate that:

- High potassium intake is associated with decreased stroke mortality.

Dietary intake

There is good evidence in the scientific literature to indicate that:

- A general reduction in sodium intake could be better achieved by a reduction in the sodium content of manufactured food products than by dietary advice alone.³

Calcium and magnesium

There was no evidence found to support an association between calcium and BP. There was no evidence found to support an association between magnesium and BP or magnesium and CVD.

Table 1 summarises the key findings from the *Summary of evidence statement*.

² Conversion: 4 g of salt contains approximately 1550 mg sodium; 6 g of salt contains approximately 2300 mg sodium; 9 g of salt contains approximately 3500 mg sodium.

³ The sodium added to processed foods contributes about 80% of dietary sodium.



The relationships between dietary electrolytes and cardiovascular disease (2006)

Recommendations

The following recommendations with respect to dietary electrolyte intake are made to improve the health of all Australians and reduce the current level of cardiovascular disease.

These recommendations are based on the publication *Summary of evidence statement on the relationships between dietary electrolytes and cardiovascular disease* as well as the Heart Foundation's healthy eating recommendations. For more information, visit **Heartsite** at www.heartfoundation.com.au.

The National Heart Foundation of Australia recommends that:

All Australians

1. Reduce their salt intake to less than 6 g of salt a day⁴ (approximately 2300 mg of sodium a day⁵), which is approximately 1½ teaspoons of salt.
2. Decrease their sodium intake by:
 - choosing foods normally processed without salt and foods labelled 'no added salt' or 'low salt' ('low salt' means no more than 120 mg of sodium per 100 g)
 - choosing 'reduced salt' products if these are the lowest salt options available
 - avoiding high salt processed foods
 - limiting salty snacks and takeaway foods high in salt
 - avoiding adding salt during cooking and at the table.
3. Increase their potassium intake.⁶ Food sources of potassium appear to have a greater benefit than supplements, therefore incorporate:
 - a wide variety of fruits and vegetables
 - plain, unsalted nuts (however, limit quantity and frequency as nuts can contribute to excess kilojoules)
 - dried peas, dried beans or lentils
4. Base their eating patterns on:
 - mainly plant based foods—fruits, vegetables and a wide selection of wholegrain based foods
 - moderate amounts of low or reduced fat dairy products
 - moderate amounts of lean unprocessed meats, poultry and fish
 - moderate amounts of reduced salt polyunsaturated and monounsaturated fats.
5. Choose foods and meals with the Heart Foundation Tick. Tick approved foods and meals meet strict standards for sodium/salt content in addition to saturated fat, trans fat, and where appropriate, kilojoules, fibre and serve size.
6. Discuss healthy eating and concerns about nutrition with an Accredited Practising Dietitian or a doctor.
7. Visit **Heartsite** at www.heartfoundation.com.au or ring **Heartline** on **1300 36 27 87** (local call cost) for further healthy eating information.

Health professionals

When advising patients or clients with high BP or those with or at risk of CVD, include the nutrition recommendations above with specific emphases on the following:

1. Advise patients to reduce their salt intake to less than 4 g of salt a day (approximately 1550 mg of sodium a day), which is approximately one teaspoon of salt.
2. Encourage patients to choose an eating pattern that has minimal added salt, as well as to choose 'low salt' foods (no more than 120 mg of sodium per 100 g) or 'no added salt' processed foods.
3. Advise patients not to add salt during cooking or at the table.
4. Advise patients to increase their potassium intake.⁶

⁴ The dietary requirement for sodium is only 460–920 mg/day (1.2–1.6 g salt) but such levels are not feasible with the current food supply. These recommendations are consistent with the 2006 National Health and Medical Research Council Nutrient Reference Values for Australia and New Zealand.

⁵ Sodium is listed on the Nutrition Information panel of the product package.

⁶ People with renal impairment should discuss dietary changes with their doctor. Increasing dietary potassium intake to reduce BP is only applicable in those with normal renal function.



The relationships between dietary electrolytes and cardiovascular disease (2006)

Governments

1. Commit to collecting Australian population dietary intake data (including electrolytes) through a thorough and regular national nutrition survey.
2. Set a target for reducing the average salt consumption of adults to less than 6 g a day by 2010.⁷
3. Introduce mandatory salt labelling in addition to sodium so consumers can clearly identify the salt content of foods.
4. Develop a social marketing campaign to increase Australians' awareness of the importance of reducing salt consumption.
5. Establish salt reduction targets for key product categories as well as meals supplied by retailers, food manufacturers and the food service sector.
6. Commit to ongoing support for a national campaign to increase the consumption of fruit and vegetables in the Australian population.

Industry

1. All sectors of the food industry—retailers, manufacturers, trade associations, caterers, public procurement and suppliers to the catering industry—should be engaged in a salt-reduction program to decrease the sodium content of foods within their product range as well as increasing the proportion of healthier choices.
2. Develop or reformulate foods that are:
 - lower in sodium, through gradual reduction in order to adjust to food safety, consumer acceptance and palatability
 - higher in potassium.
3. Work with the Heart Foundation Tick Program⁸ to meet nutrition standards in the retail and food service areas.

Background information

The 2006 National Health and Medical Research Council recommendations for all Australians are to consume no more than 2300 mg of sodium (100 mmol/day), and no more than 1600 mg of sodium to prevent chronic disease. The current recommendations for potassium are to consume at least 3800 mg a day for men, 2800 mg a day for women, and 4700 mg a day in order to prevent chronic disease.

Many randomised trials have been conducted to assess the effects of electrolytes on BP but there is still some controversy about the magnitude of the fall in BP and whether this translates into a longer term reduction of CVD.

The evidence obtained from a systematic review of all relevant randomised controlled trials is considered to be the most robust and good quality evidence (National Health and Medical Research Council, 1999). Our review has based its conclusions on the highest quality evidence available after assessing each paper individually. Our criteria used to appraise the scientific evidence were based on consistency across a range of study designs, the quality of each study and consideration of measurement bias, the size of the effect and the demonstration of a biologically plausible mechanism. The terms 'good', 'moderate' and 'weak' evidence were used to assess the strength of the scientific evidence.⁹

⁷ This recommendation is consistent with the 2006 National Health and Medical Research Council Nutrient Reference Values for Australia and New Zealand.

⁸ The purpose of the Heart Foundation Tick is to improve the nutrition of the foods Australians and their families eat most often. They do this by challenging food companies to reformulate foods to meet the guidelines and then highlighting these healthier foods with the Heart Foundation Tick.

⁹ Criteria used to assess the evidence:
 Good evidence: systematic reviews and RCTs, consistent findings, large studies, measurement bias adequately minimised, statistically significant;
 Moderate evidence: RCTs, observational studies, large studies, use of surrogate measures, limited number and type of studies, limited in quality, effect possibly due to measurement bias; and
 Weak evidence: RCTs, observational studies, small, individual trials, inconsistency across study findings, limited number and type of studies, limited in quality, effect possibly due to measurement bias.



The relationships between dietary electrolytes and cardiovascular disease (2006)

Table 1: Summary of key findings

Summary of evidence	Key studies
A reduction in dietary sodium of approximately 75 mmol/day results in a fall in systolic BP of 4–5 mm Hg in hypertensive individuals (baseline systolic BP \geq 140 mm Hg) and a fall in systolic BP of 2 mm Hg in normotensive individuals (baseline systolic BP <120 mm Hg). (<i>good evidence</i>)	He and MacGregor, 2004 (S); Cutler et al. 1997 (S).
A reduction in dietary sodium from 140 to 100 mmol/day results in a fall in systolic BP of 2 mm Hg from an average systolic BP of 135 mm Hg. (<i>good evidence</i>)	Sacks et al. 2001 (R).
A reduction in dietary sodium from 140 to 65 mmol/day results in a fall in systolic BP of 7 mm Hg from an average systolic BP of 135 mm Hg. (<i>good evidence</i>)	Sacks et al. 2001 (R).
Reducing dietary sodium along with weight loss results in a greater fall in systolic BP than reducing dietary sodium alone. (<i>weak evidence</i>)	Miller et al. 2002 (R); The Trials of Hypertension Prevention Collaborative Research Group, 1997 (R); Whelton et al. 1998 (R).
A high dietary sodium intake is associated with increased stroke incidence, and mortality from coronary heart disease and CVD. (<i>moderate evidence</i>)	He et al. 1999 (O); Tuomilehto et al. 2001 (O).
A general reduction in sodium intake could be better achieved by a general reduction in the sodium content of manufactured food products than by dietary advice alone (<i>good evidence</i>) and whole foods have a greater effect on BP than supplements; note that supplemental potassium has the potential for toxicity. (<i>good evidence</i>)	Griffith et al. 1999 (S); Hooper et al. 2002 (S); Sacks et al. 2001 (R).
An increase in dietary potassium intake of approximately 54 mmol/day results in a fall in systolic BP of 4–8 mm Hg in hypertensive individuals (baseline systolic BP \geq 140 mm Hg) and a fall in systolic BP of 2 mm Hg in normotensive individuals (baseline systolic BP <120 mm Hg). (<i>good evidence</i>)	Cappuccio & MacGregor 1991 (S); Geleijnse et al. 2003 (S); Whelton et al. 1997 (S).
A high potassium intake is associated with decreased stroke mortality (<i>moderate evidence</i>) and decreased CVD mortality. (<i>weak evidence</i>)	Ascherio et al. 1998 (O); Chang et al. 2006 (O); Fang et al. 2000; Khaw & Barrett-Connor 1987 (O); Xie et al. 1992 (O).
Responsiveness to increased dietary potassium intakes is greater in subjects with high sodium intakes (<i>weak evidence</i>) and responsiveness to decreased sodium intakes is greater in subjects with low potassium intakes. (<i>weak evidence</i>)	Grimm et al. 1990 (R); Morgan et al. 1984 (R); Morgan 1982 (R); Whelton et al. 1997 (S).
A high calcium intake reduces the risk of ischaemic stroke. (<i>weak evidence</i>)	Abbott et al. 1996 (O); Elwood et al. 2005 (O); Iso et al. 1999 (O); Umesawa et al. 2006 (O).

S – systematic review/meta analysis

R – randomised controlled trial

O – observational studies



Future research

Further studies are needed to clarify the evidence that:

- reducing dietary sodium is associated with a reduced risk of CVD
- reducing dietary sodium along with weight loss is associated with a greater fall in systolic BP than reducing dietary sodium alone
- increasing potassium intake is associated with a reduced risk of CVD
- there is a greater BP response to increased dietary potassium intakes in subjects with high sodium intakes
- there is a greater BP response to decreased sodium intakes in subjects with low potassium intakes
- high calcium intake is associated with a fall in BP and reduced risk of CVD
- high magnesium intake is associated with a fall in BP and reduced risk of CVD.

While there is relatively good evidence of the physiological effects of dietary sodium and potassium intake as they relate to BP, there is less evidence currently available regarding the impact of magnesium and calcium.

The *Summary of evidence statement* has highlighted the paucity of research conducted in Australia. More Australian trials are needed to determine how to reduce dietary sodium and/or increase dietary potassium in the Australian context.

There is a need to assess the intake and sources of electrolytes in the diet through a national nutrition survey.



The relationships between dietary electrolytes and cardiovascular disease (2006)

References

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For the detailed discussion of the evidence supporting these recommendations, please refer to the Heart Foundation publication *Summary of evidence statement on the relationships between dietary electrolytes and cardiovascular disease* available from **Heartsite** at www.heartfoundation.com.au.

Separate Q&A documents for health professionals and the general population can also be obtained from **Heartsite**.

The information contained in this Position Statement is current as of October 2006.



About the Heart Foundation

The National Heart Foundation of Australia is the leading organisation in the fight against cardiovascular disease (heart, stroke and blood vessel disease) in Australia. As a charity, the Heart Foundation relies on donations and gifts in wills to continue our lifesaving research, education and health promotion work.

Cardiovascular disease claims the lives of more than one in three Australians. We aim to reduce cardiovascular-related death and disability by

- funding world class medical and scientific research
- informing and educating the public
- promoting lifestyles that improve cardiovascular health
- developing guidelines for health professionals
- assisting people who have suffered from cardiovascular disease by promoting treatment and rehabilitation.

Heartline

Heartline is the Heart Foundation's national telephone information service, staffed by trained health professionals in heart health.

Call **1300 36 27 87** (local call cost) during business hours for information on heart health issues such as healthy eating, physical activity, quitting smoking, controlling blood pressure, cholesterol, heart disease and stroke, and heart surgery. Please note that **Heartline** is not an emergency, diagnostic or counselling service.

Heartsite

The Heart Foundation's website provides you with access to all our latest heart health and programs information, cookbooks, and policies and guidelines for health professionals. You'll also find details about local events and information about how you can support the Heart Foundation. Visit www.heartfoundation.com.au today.