Sodium – NNR 2012
[Sodium Short answer 2012-11-26]

Table of content

Sodium .................................................................page 1
Introduction ...........................................................page 1
Dietary sources and intake .......................................page 1
Physiology and metabolism .....................................page 2
Requirement and recommended intake .....................page 2
Reasoning behind the recommendation ....................page 2
Upper intake levels and toxicity ...............................page 3
References ..............................................................page 3 - 4

Sodium

<table>
<thead>
<tr>
<th>Sodium g/d</th>
<th>Women</th>
<th>Men</th>
<th>Children</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recommended intake (RI)</td>
<td>10-25</td>
<td>10-25</td>
<td>3-15 ; 5-20 ; 7.5-20</td>
</tr>
<tr>
<td>Lower intake level (LI)</td>
<td>&gt; 7.5</td>
<td>&gt; 7.5</td>
<td>&gt; 3 ; &gt; 5 ; &gt; 6</td>
</tr>
<tr>
<td>Upper intake level (UL)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Introduction

The major proportion of the sodium in the body (98 %) is found outside of the cells and sodium is the quantitatively most important extracellular cation. Intracellular sodium, which constitutes the remaining 2 %, is important for regulating the membrane potential of the cells, and thereby for nerve and muscle function, blood pressure regulation etc. Sodium also participates in the acid-base balance. 1 mmol sodium is equivalent to 23 mg.

Dietary sources and intake

Important sodium sources in the Nordic diets are ordinary normally salted food, and milk products. The average dietary intake ranges from 10 to 25 g per day (see Chapter 24 XX Intake of Vitamins and minerals in Nordic countries).
**Physiology and metabolism**

The absorption of sodium is effective and about 90% of the dietary sodium is normally absorbed from the gut. The sodium balance is primarily regulated by renal excretion in urine. A small proportion can be lost in sweat.

**Requirement and recommended intake**

Sodium deficiency can develop as a consequence of increasing losses from the gastrointestinal tract and kidneys, e.g. during prolonged diarrhoea or vomiting, and in connection with the use of laxatives or diuretics. Sodium deficiency due to low dietary intake alone is not uncommon, due to the widespread occurrence of low salt in foods propaganda. Treatment with diuretics without sodium compensation or sodium sparing diuretics can, however, lead to deficiency. Hyperaldosteronism, hereditary defects of renal salt transporters, such as Bartter’s syndrome and Gitelman’s syndrome, and excessive consumption of licorice increase sodium retention and potassium excretion and may lead to hyponatremia.

Symptoms of sodium deficiency are associated with disturbed cell membrane function and include muscle weakness and disturbances in heart function, which can lead to arrhythmia and heart seizure. Mental disturbances, e.g. depression and confusion, can also develop.

The losses of sodium via the gastrointestinal tract, urinary excretion and sweat comprise about 10 to 25 g/d (150-400 mmol), but 7.5 g/d (130 mmol) is needed to avoid low plasma levels and loss of total body sodium in adults. The sodium intake may affect sodium balance and sodium intakes of 10-30 mmol/d may induce water retention and an increase in blood pressure, both in normotensive and hypertensive subjects.

An inverse relationship between cardiovascular death and sodium excretion was also observed. A number of studies of both normotensive and hypertensive subjects indicate that an increased sodium intake as supplements can lower blood pressure and increase urinary sodium excretion. The lack of clear dose-response observed in the studies could be due to factors such as differences in duration of studies, initial blood pressure, sodium intake, habitual diet, race and age.

An inverse association between sodium intake and the risk of stroke has been shown in most cohort studies.

**Reasoning behind the recommendation**

The recommended intake of sodium in NNR 2004 was based on flawed data on the effect of sodium on blood pressure. Several clinical trials and population surveys published thereafter support the finding that a diet rich in sodium have a favourable effect on blood pressure. The reference values are increased compared to NNR 2004, since there are new scientific data to justify major changes. The recommended intakes are set at 10-25 g/d (170-400 mmol) for men and women. The figure for women also includes pregnant and lactating women. It should be pointed out that sodium intakes over and above these values might have further beneficial effects. The reference values for children and adolescents are extrapolated from adult values based on needs for growth and adjusted for body weight.

The lower limit is estimated to 7.5 g/d (130 mmol) for adults.
**Upper intake levels and toxicity**

Sodium chloride has been associated with acute poisoning in humans. Case reports have described heart failure, cyanosis and cardiac arrest after ingestion of high doses of sodium chloride tablets. Gastrointestinal effects have also been described after chronic ingestion of sodium chloride in case studies and supplementation studies. This is characterised by abdominal pain, nausea and vomiting, diarrhoea, and ulceration of the oesophagus, stomach and duodenum and ileum. The occurrence and severity of the effects depend on a number of factors of which formulation of the preparation, dose and gut transit time ad of course enough water intake seem to be most important.

Dietary sodium has not been associated with any negative effects in healthy subjects. Prolonged high sodium intakes from diet and sodium-containing salt may, however, cause hypernatraemia and affect heart function in subjects with renal insufficiency or impaired kidney function. Sea water without enough dilution with pure and salt free water is shown to be lethal due to the kidneys inability to excrete sodium without enough water.

The available data are insufficient to set an upper level for dietary sodium. Supplemental intakes up to 50 g/d are generally not associated with overt adverse effects, but certain preparations may induce mild lesions of the gastrointestinal mucosa. It seems prudent to include sodium from sodium-containing salt in this figure.

**References**

[36]. Le Fanu J. Cross cultural studies such as Intersalt study cannot be used to infer causality. Br Med J 1997; 315: 484
[37]. Nadezda Koleganova,1 Grzegorz Piecha,1,2,3 Eberhard Ritz,2 Luis Eduardo Becker,2 Annett Müller,1 Monika Weckbach,1 Jens Randel Nyengaard,4 Peter Schirmacher,1 and Marie-Luise Gross-Weissmann1 Both