

Annotations

Blood pressure, sodium, and take away food

Relationship between sodium and hypertension

'Interest in salt and its effect on blood pressure is waxing again'¹ and there is increasing evidence that high blood pressure may be caused by high sodium intake in susceptible individuals. There are two possible ways in which sodium may be concerned in the initiation of hypertension. Firstly there may be a primary increase in blood volume and hence in cardiac output,² and secondly there may be an increase in peripheral resistance associated with increased stiffness of blood vessels related to the intracellular sodium content.^{3 4}

Recent work that implicates sodium in the pathogenesis of hypertension is the relationship between hypertension and sodium flux across red cell membranes present in hypertensive patients and in their first-degree relatives,⁵⁻⁷ and the relationship seen in populations, rather than in individuals, between dietary sodium and high blood pressure. For example, the northern Japanese eat a lot of salt fish and have an estimated sodium intake of 268 mmol/day. The incidence of hypertension is 40%.⁸ In contrast, the Yanomamo Indians have a 'no salt' culture. Among them, hypertension is almost unknown, and blood pressure does not rise with age.⁹ As with all such epidemiological studies there are other differences between the urban Japanese and the rural Yanomamo, apart from their salt intake. Furthermore, the relationship between sodium intake and blood pressure has not been shown in individuals in a community.¹⁰ It is therefore likely that sodium intake is related to blood pressure only in individuals who are susceptible for other (unknown) reasons.

The animal model of salt susceptibility is well developed. There are several strains of rat that will develop hypertension when fed a diet containing sufficient sodium.^{11 12}

In addition, there is evidence that a modest reduction in sodium intake from a mean of 162 mmol/24 hours to a mean of 90 mmol/24 hours will reduce blood pressure in mildly hypertensive subjects.¹³ The reduction of 7 mmHg is comparable with that seen with treatment with beta adrenergic blocking agents.¹³ Kempner long ago found that an intolerably low sodium-containing diet (the rice diet,

10 mmol/24 hours) greatly reduced blood pressure in severe hypertension.¹⁴

Development of 'hypertension' in childhood

If human hypertension is related to sodium intake, when is this expressed? Although hypertension is generally treated in patients when aged between 30 and 50 there is evidence that hypertension is present long before. For example, the 'thousand aviator' study showed that those who eventually had hypertension at age 48 were much more likely to have been in the higher echelons of the blood pressure distribution at entry to the US Air Force at a mean age of 24.¹⁵ Zinner *et al.*¹⁶ demonstrated that children aged 4 to 14 with fairly high blood pressure on first examination were more likely to be in the upper centiles for blood pressure at follow-up 4 and 8 years later. This suggests that children are 'getting on track' for blood pressure by age 4. If the correlation coefficient of blood pressure measurements repeated at yearly intervals is taken as a measure of tracking (tracking coefficient), this reaches a maximum of 0.7 by age 18.¹⁷ The Brompton study showed that the tracking coefficient is 0.46 at four years and 0.2 at one.¹⁸ There is therefore evidence that children are on track for blood pressure from the first year of life. If dietary sodium is a factor in the pathogenesis of hypertension, pediatricians have a responsibility to warn children and their parents about the risks of excessive sodium intake.

Sodium content of processed foods

As a recent article about salt in *Time* stated, 'The diamond crystal has become the demon crystal and the number 1 food fear'.¹⁹ There may be more justification for this than for most food fads, since the sodium content of processed food can be considerable, and greatly in excess of a similar diet cooked at home from raw ingredients. The consumer may not necessarily be aware of this, because the sodium is present as sodium glutamate added to improve flavour or as sodium nitrite as a preservative rather than as sodium chloride. For example, one average sized potato contains 0.2 mmol sodium, but one cup of instant mashed potato contains

21 mmol.¹⁹ The sodium content of all prepared foods should therefore be incorporated in the label among the other constituents and additives. However, the leaders in sodium content are take away foods. A well-known brand of hamburger and chips contains 97 mmol of sodium per portion, and of fried chicken 75 mmol per portion.¹³ One small Chinese take away meal contained 225 mmol of sodium, or nearly twice the average adult daily intake.¹³

The take away food business is booming as our social patterns change. In America, whose habits the rest of the developed world frequently follow, McDonald sells 700 million pounds (3.18×10^8 kg) of hamburger, and 542 million bushels (1.9×10^9 litres) of fries per year.¹⁹ Although the occasional hamburger will do no harm, some children seem to live on a diet of hamburger and chips, and it is their parents whom we should counsel. Particularly at risk are those who are likely to develop hypertension or atheromatous cardiovascular disease—that is the obese, diabetics, and those with a family history of cardiovascular disease. Other important risk factors in teenagers may be smoking and taking the contraceptive pill.

Paediatricians have long been aware of the risks of excessive sodium content in infant feeds. They should now realise that the sodium content of older children's diets is important too.

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