

## Research Highlight

## Dietary salt intake and stroke

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Stroke is one of the leading causes of mortality. The risk factors for stroke include hypertension, coronary heart diseases, diabetes and obesity<sup>[1]</sup>, in which hypertension is the top risk factor. Worldwide, hypertension is the leading preventable risk factor for death; and causes 54% of strokes<sup>[2]</sup>. While stroke is one of the leading causes of mortality in the industrialized countries, the effects of elevated blood pressure on the Asian population also raise a concern. As in 2002, hypertension affects almost 20% of the population of China, which amounts to 160 million people<sup>[3]</sup>. Moreover, stroke is the major complication of hypertension in Chinese population<sup>[3]</sup>. Chinese Medical Association reported 3 million stroke deaths in 2009, more than twice that of 1985<sup>[3]</sup>.

Sodium is essential in regulating blood volume, blood pressure, osmotic equilibrium and pH, but excess intake of dietary sodium (salt) leads to fluid retention and subsequent rise in blood pressure. A diverse body of evidence, including animal, clinical and epidemiological studies, has implicated excess dietary sodium intake as one of the major factors associated with the development of hypertension and subsequent increase in stroke risk<sup>[2]</sup>. Canadian Stroke Network estimated that bringing consumption of sodium to healthy levels

(less than 1500 mg/d) would reduce the incidence of hypertension by 30%, which amounts to over a million Canadians<sup>[4]</sup>. It has been estimated that up to 23 500 cardiovascular episodes, such as myocardial infarctions and strokes and 17 000 deaths annually could be prevented if sodium consumption was cut in half in Canada<sup>[5]</sup>. While the American Heart Association recommends the upper level of sodium intake to be 1500 mg/d, in reality it is greatly exceeded, with Canadians consuming more than double of the recommended dose according to Canadian Stroke Network<sup>[4]</sup>. Most of the sodium consumed by general population comes from processed and prepared foods with nutritional labelling that is often unclear or misleading. While many countries including Canada<sup>[6]</sup> have started to reduce their sodium content targets in processed foods, individuals must take an active role in controlling their sodium intake by reading nutrition labels and avoiding packaged and processed foods.

Some of the most convincing clinical evidence on the effects of sodium on blood pressure comes from rigorously controlled, dose-response trials<sup>[2]</sup>. The DASH (Dietary Approaches to Stop Hypertension)-Sodium trial is the largest of three major dose-response trials. It tested the intake of high, intermediate and low levels of sodium, with lowest levels of 1500 mg/d – the dose currently recommended by American Heart Association<sup>[7]</sup>. It documented that reduced sodium intake significantly lowered blood pressure in every

major subgroup studied (those with and without hypertension, men, women, African-Americans and non-African Americans)<sup>[7]</sup>. The study also demonstrated that the sodium intake reduction had an effect on age-related rise in blood pressure. For example, the sodium reduction to a level of approximately 1500 mg/d lowers blood pressure more in older individuals than in younger individuals. Systolic blood pressure was reduced by 8.1 mmHg in those aged 55 to 76 years, compared with 4.8 mmHg for adults aged 23 to 41 years. In persons without hypertension, blood pressure decreased by 7.0 mmHg in those older than 45 years of age compared with 3.7 mmHg in those younger than 45 years of age<sup>[7]</sup>. As blood pressure has a direct relationship to stroke incidence, the reduction in dietary sodium intake would reduce the risk of



**Figure 1.** Sodium is an essential element in our body, and we need to intake salt through diet. "Think three times before you act". Be conscious how much salt you should add to your food. (Artwork by Jonathan F SUN)

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stroke. There has been substantial evidence supporting a direct relationship between sodium intake and cardiovascular diseases and stroke. Recent trials testing lifestyle interventions that are focused on reduced sodium intake have reported significant effects on cardiovascular diseases and stroke outcomes in general populations. There was a 21% to 41% reduction in clinical cardiovascular diseases and stroke events in those who received a reduced sodium intervention<sup>[8]</sup>. This evidence is consistent with indirect evidence on the benefits of reducing sodium intake on blood pressure. In addition, increased dietary intake of sodium has numerous adverse effects that are independent of blood pressure. These include ventricular fibrosis, kidney damage, gastric cancer, disordered mineral metabolism, oxidative stress and endothelial dysfunction<sup>[2]</sup>.

According to Canadian Stroke Network, a recent study found that 100% of bedside meals in three Ontario acute-care hospitals had higher than recommended daily sodium levels<sup>[4]</sup>. The mean sodium level in standard preset daily menus received by patients in general medical wards, surgery wards and cardiology wards was 2896 mg, almost double of the recommended daily intake

by the American Heart Association, and surely more than upper tolerable limit set by Canadian Stroke Network<sup>[9]</sup>. As commented by Dr Hong-shuo SUN, a Canadian Stroke Network researcher, it is important to educate the general population that the reduction of dietary salt intake to approximately 1500 mg/d can reduce the risk of stroke, especially for aged population. This will make significant impact on preventing stroke, and thus reducing overall morbidity and mortality of cardiovascular diseases and stroke. It is a call to health professionals such as physicians and dieticians to take an active role in educating not only the general public but also the food industry to promote low salt healthy diet. It is anticipated the total direct and indirect costs related to stroke, including cost of physicians and other professionals, medications, hospital services, home care services and others to be reduced, with the increasing public awareness of the importance of reducing dietary salt intakes (Figure 1).

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