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Scientists lift the lid on salt's hypertensive power

By Stephen Daniells, 11-Mar-2009

Salt may raise lead to hypertension by inhibiting the action of an enzyme linked to easing blood flow, says a new joint US-Chinese study.

Researchers from the University of Kentucky Medical School and Taishan Medical College report that high salt levels in the blood, as would be observed in people with high salt intake, could significantly suppress the activity of an enzyme called nitric oxide synthase (NOS).

NOS is the enzyme that produces nitric oxide (NO), a molecule used by the cells lining blood vessels (endothelial cells) to signal surrounding muscle to relax, and thereby improving blood flow and reducing blood pressure.

Xiang-An Li, lead author of the study and an assistant professor at the Kentucky Pediatric Research Institute, told FoodNavigator: *"To the best of our knowledge, we provide the first direct evidence demonstrating that high salt inactivates NOS in endothelial cells. A number of previous reports suggested so.*

"Our study clearly indicates the importance of lowing salt intake," he added.

Numerous scientists are convinced that high salt intake is responsible for increasing blood pressure (hypertension), a major risk factor for cardiovascular disease (CVD).

Salt is of course a vital nutrient and is necessary for the body to function, but campaigners for salt reduction, like the Consensus Action on Salt and Health (CASH) consider the average daily salt consumption in the western world, between 10 and 12g, far too high.

The pressure has been mounting on food manufacturers to reduce the salt content of their foods and the UK's food standards agency (FSA) recommendation of six grams of salt per day for the general population is understood to be more a realistic target than the ideal healthy limit recommended by WHO/FAO.

"Our findings demonstrated that NOS is sensitive to changes in salt concentration," wrote the researchers. *"A 5-mmol/L rise in salt concentration, within the range observed in […] individuals with high salt intake, could significantly suppress NOS activity.*

"*This salt-induced reduction in NO generation in endothelial cells may contribute to the development of hypertension,"* they added.

Study details

Li and his co-workers used three separate analytic tests to investigate how increases in sodium levels may alter the function of NOS in endothelial cells.

The laboratory study used living cells of bovine origin to show that an increase in salt concentration from 137 to 142 mmol/L (ie. 5-mmol/L) resulted in a 25 per cent decrease in NOS activity.

"Importantly, the decrease in NOS activity was in a salt concentration-dependent manner," they stated.

Indeed, an increase in salt levels of 20 mmol/L was associated with a 70 per cent reduction in NOS activity.

These observations were further confirmed using Chinese hamster ovary cells, which also showed that the effects were not merely due to osmosis.

The dose-dependent response was also observed following *in vivo* infusion of salt following aortic angiogenesis assay.

Commenting on the mechanism, Dr Li said that blood pressure regulation is complex and involves multiple mechanisms. *"Our study demonstrates that inactivation of NOS by salt is one of the mechanisms"*

Dr Li confirmed that research in this area was ongoing, noting that circulating blood contains a number of other metal ions beyond sodium, such as potassium, magnesium and calcium. *"It is of interest to elucidate whether these ions affect salt-NOS interaction,"* he said.

Salt reduction

Earlier this year, scientists from Harvard Medical School reported in the *Archives of Internal Medicine* that higher

sodium and lower potassium intakes may increase the risk of heart disease by 24 per cent.

The trials of hypertension prevention (TOHP) I and II – looked at the effects of sodium reduction and other interventions on the risk of cardiovascular disease (CVD). Researchers, led by Nancy Cook from Harvard Medical School, found that increasing levels of sodium in the urine increased the risk of CVD.

"The totality of evidence suggests that lowering dietary sodium intake, while increasing potassium consumption, at the population level might reduce the incidence of CVD," wrote Cook.

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"Salt Inactivates Endothelial Nitric Oxide Synthase in Endothelial Cells"
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