

## Dietary Sodium: Dogma, Doubt, Delusion and Just What Is Desirable?

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Salt (half of which is sodium), health and the 2013 Institute of Medicine (IOM) report concerning dietary sodium recommendations was the subject of a major symposium at the April 2014 American Society of Clinical Nutrition (ASCN) scientific meeting. The Centers for Disease Control (CDC), recognizing evidence that severe sodium reduction might harm health, had commissioned the IOM to update recommendations about sodium intake.

The 2013 IOM report concluded that 1) there is a risk of more cardiovascular disease with high sodium intake; 2) studies are inconclusive about the health effect on the general population when dietary sodium falls below 2300 mg/day (about 2 teaspoons of salt); 3) sodium restriction below 2300 mg/day is harmful for patients with heart failure; and 4) there is not enough evidence to determine if people at high risk for vascular disease should limit sodium intakes to less than 2300 mg/day.

The ASN symposium presenters agreed with the harm of extreme sodium restriction in heart failure patients, but felt that the IOM's conclusions did not go far enough in other people.

**Dogma:** A substantial body of evidence, mostly from Westernized societies, links excessive dietary sodium to hypertension, stroke and heart disease. These studies assumed, without actual data, that lowering sodium intake all the way to zero would result in ever lower risk of hypertension (high blood pressure) and disease.

Bunching together results from many experiments yields an average drop of 3 to 5 points in the top blood pressure number and a small dip of 0.8 to 2 points in the bottom number. People eating huge

amounts of sodium responded the best, especially if they were obese.

In 2010 the Department of Health and Human Services and the Department of Agriculture updated the Dietary Guidelines for Americans (DGA) in response to a general acceptance of the need for sodium reduction. Their goals were for everyone to eat less than 2300 mg sodium per day. High risk people were to shoot for a more stringent goal of 1500 mg/day. People at high risk include African Americans, those older than 50 years and anyone who already has hypertension, diabetes or chronic kidney disease.

Dietary sodium currently averages 3400 mg/day in U.S. adults (range 2000-5000). This is an improvement, down 500 mg/day from 10 years ago, but failure to meet DGA guidelines causes consternation in many public health officers.

**Doubt:** Should these guidelines really apply to everyone? A pile of data show that there are sodium responders and non-responders. Only a few people with normal blood pressure drop their pressure in response to less dietary sodium. Salt-responsiveness may change over the life-span – For example, salt-sensitivity in some obese hypertensive teens dissipates with weight loss.

African-Americans as a group retain sodium more than do Caucasians, but among both groups blood pressure response to sodium is variable and very dependent on genetics. Salt sensitivity is related to at least a dozen genes, not all of which have an obvious connection to sodium and blood pressure.

In the DASH (Dietary Approaches to Stop Hypertension) trial of people with high blood pressure, a fruit and vegetable-rich prudent diet slashed the average systolic pressure by 11 points and the diastolic pressure by 5 points. Unlike the sodium data, the DASH diet lowered blood pressure

in all categories of people. Blood pressure didn't drop any further when subjects also limited salt.

Diets low in potassium and calcium foster higher blood pressure. Salt decreases potassium and calcium levels by increasing urinary losses. Could this be part of the reason that sodium raises blood pressure? Should we be focusing more on increasing dietary potassium and calcium and less on reducing sodium?

Other data suggests that chloride, not sodium, may be the problem. In animals, non-chloride sodium compounds, such as sodium glutamate, sodium bicarbonate, sodium ascorbate and sodium phosphate, do not raise blood pressure.

**Delusion:** Data from world-wide studies strongly supports a J-shaped curve for the association between sodium intake and health outcomes, including but not limited to hypertension. A J-shaped curve looks like a Nike swoosh, showing increased risk at both the low and high ends of intake. Health risk steeply rises as dietary sodium falls below 2300 mg/day. Between 2300 and 3500 mg/day risk is low and relatively flat, then slowly increases through 5000 mg/day. After that risk rises more steeply with higher intakes.

In spite of this data, which has been available since the 1990's, the American Heart Association recommends less than 1500 mg/day for everyone, based mostly on blood pressure studies. The World Health Organization sets goals of less than 2000 mg/day, but couples that with a recommendation to eat at least 3510 mg potassium per day.

We need sodium. It is essential for cellular and organ function, energy generation, blood pressure support, nerve and muscular function and proper kidney function. Even mildly low sodium levels can cause weakness and problems with thinking and memory, especially in the elderly.

Excessive sodium restriction has good reason to backfire, especially in heart failure patients. Very low sodium intake activates a regulatory system called RAAS, which tightly controls sodium levels. The RAAS thinks that low sodium means low blood

pressure and the body is at risk of dying. It senses sodium intakes below 1500 mg/day and kicks in to raise blood pressure.

RAAS is great as a fail-safe mechanism to prevent death from low sodium and blood pressure, but its persistently high activation contributes to thickening of the heart muscle and kidney tissue. That's the opposite of what we should want for our heart failure patients, or anyone else for that matter.

Very low sodium intake also increases sympathetic nervous system activity, which raises heart rate and blood pressure. It increases insulin resistance, accelerating the journey to overt diabetes.

Until now the many in the science community rejected the J-shaped curve and unhealthy effects of excessive sodium restriction as "improbable." It didn't fit accepted knowledge, so it was considered faulty. Critics emphasized the studies' methodological problems, without acknowledging the same problems with the lower-sodium-is-better studies.

**Desirable:** In 2005 the IOM accepted the J-shaped curve and set an "adequate intake" recommendation of more than 1500 mg/day, but didn't call it a requirement. The IOM's 2013 guidelines go a step further, stating that very low dietary sodium is unhealthy for patients with heart failure.

In spite of this shift by the IOM, government policy and physician recommendations have not changed concerning very low sodium intakes.

The presenters at the ASCN symposium, all eminent nutrition scientists, suggested that 2300 – 4945 mg/day is OK *in most people*, depending on genetics and other life-style factors. That range happens to coincide with usual intake by the majority of societies across the globe – both Westernized nations suffering from an epidemic of cardiovascular disease and subsistence societies virtually free of that scourge.

The ASCN presenters basically castigated policy makers for continuing the lower-is-better view. They also felt that a population-wide effort to

restrict sodium intake to 2300 mg/day 1) is not supported by the data; 2) is a misplaced use of effort and resources; and 3) potentially increases harm when the elderly with minimal sodium intake become weak and fall from inadequate blood levels, or zero-sodium zealots develop unwanted cardiovascular effects of an activated RAAS.

Cardiologists argue against policy change, fearing that deemphasizing salt restriction will keep people from reducing it at all. That's a valid concern since very high sodium diets *are* bad for health, especially in those whose idea of a low-sodium diet is to eat only half the bag of chips.

Continuing to focus entirely on sodium ignores the compelling DASH and potassium benefit. A recommendation to eat minimally processed food diets (processed food generally has a lot of sodium), full of vegetables, whole grains, fruits, low-fat dairy and lean animal products focuses on all the good things, not just salt.

The taste for salt is the only taste sensation that turns both on *and* off according to the body's need. Anyone consuming a DASH diet who craves salt should eat some.

The J-shaped curve has been around for a long time. The IOM accepts it as valid, and they are a tough audience. Policy-makers should heed the advice of the IOM and the implications of all the scientific data, not just the biased data that drive their policy.