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TAKE THE LATEST LOW SODIUM ADVICE WITH A GRAIN OF SALT

KEYWORDS: "The Last Supper", covenant of salt, Sumo wrestling, Walter Kempner, Lewis Dahl, low sodium diet studies, diuretics vs. antirenin drugs, the "Laragh Method"

The "diet dictocrats" are at it again. The latest NHLBI (National Heart Lung and Blood Institute) warning is that Americans are eating too much salt and are therefore at increased risk for hypertension, stroke and heart attacks. Others claim that excess sodium is a poison that can also cause cancer and osteoporosis. NHLBI recommends that not only high blood pressure patients but also all Americans should sharply reduce their sodium intake, regardless of age, gender or race. This is another example of the same, stupid "one size fits all" cookie cutter approach of treating population statistics and laboratory measurements rather than people.

This latest ban on sodium seems strange since salt has always been viewed as being very valuable. In ancient Greece, slaves were traded for salt - hence the expression "not worth his salt." Roman soldiers were sometimes paid in salt (*salis*) and their *salarium* is the origin of our word "salary". "Soldier" actually comes from the Latin (*sal dare*), which means, "to give salt".

In Biblical times, salt was used to seal a deal or agreement by what was called "the covenant of salt". Men wore a pouch of salt tied to their belt and when they made a promise to someone, each put a pinch of salt into the other's pouch. If a man wanted to break his covenant for reasons that did not seem fair, the other could respond by telling him "Yes, if you can retrieve your grains and yours only from my pouch of salt". Salt was similarly used to confirm a contract in Arabic countries but it also signified safety and friendship. If you were offered and ate salt in someone's home it was a promise that they would never harm you in any way and vice versa.

The Bible refers to the covenant of salt by which God gave the rule over Israel forever to David and his sons and in the Law of Moses requiring that all cereal offerings contain salt. Salt was valuable since it preserved foods and being called the "salt of the earth" meant that you were a valuable person. It could also refer to a group of people on whom one could rely, as when Jesus told his disciples "Ye are the salt of the

ALSO INCLUDED IN THIS ISSUE

earth, ... Ye are the light of the world." In other words they were preservatives against the damaging and spoiling effects of worldly sin.

Participants at medieval feasts were seated in order of importance based on the location of the salt dishes. Distinguished guests dined at an elegant elevated banquet table "above the salt". Lesser lights sat "below" in the boondocks in progressively lower trestle type tables.

Mystical, Sanctifying And Practical Uses

Salt was also considered to be a magical substance that could bring good fortune and prevent illness. An old Latin proverb stated "There is nothing more useful than the sun and salt" (*Nil sole et sale utilius*). Since it was essential for preserving food, spilling salt was a terrible waste that would surely bring bad luck. This led to the belief that Satan or some evil spirit must have been standing behind you to cause such an accident. The best thing to do was to immediately throw three pinches of the spilled salt over your left shoulder into his eye to blind him and scare him away. (Any good spirits would allegedly be behind you on the right.) I vividly remember my mother doing this and suspect it is still a common practice in some parts of the world.

In "The Last Supper", Leonardo da Vinci placed an overturned dish of salt in front of the scowling Judas Iscariot. Some suspect that Leonardo was aware that this represented an ill omen to prophesy the traitor's death by hanging himself. Others believe that the superstition may have started with this painting, since in describing the event, the scripture stated "Satan entered into Judas" and "supper being ended, the devil having now put into the heart of Judas Iscariot to betray him".

The Druids used salt in their Stonehenge rituals because it was believed to represent a symbol of the life-giving fruits of the earth. In old Japanese theatres, salt was sprinkled on the stage before each performance to prevent evil spirits from casting a spell on the actors and ruining the play. Salt was also thought to provide sanctification. One of the four principal tenets of the Shinto religion was the guarantee of physical cleanliness before praying or approaching a shrine, which required lots of sprinkling with salt and then washing.

This is still practiced in Sumo wrestling. The hallowed clay of the *Dohyo* or sumo ring is considered a sacred spot and must be purified the day before each tournament by the head referee and a Shinto priest, who pour sake and salt in its center. The *Dohyo* is made of packed clay and consists of a square platform with a circle made of dirt-packed straw bales imbedded in its surface. Salt is sprinkled on this before each match to cleanse the ring of "bad spirit". During the warm-up period, it is not unusual to see a wrestler sprinkling salt on his foot, bandaged knee or elbow for further protection, before throwing the rest into the ring.

In the Old Testament, Elisha also purified a spring by tossing salt into it. Nathaniel Hawthorne, whose *The Scarlet Letter* and other works are noted for their treatment of guilt and the complexities of making moral choices, similarly believed that there was something sacred about salt and wrote, "Salt is white and pure, — there is something holy in salt." In some countries, it is customary to greet newlyweds with gifts of salt and bread to bring good luck instead of throwing confetti or rice. Roman mothers rubbed salt on the lips of infants to protect them from illness and danger. Though no longer common, for hundreds of years Roman Catholic priests would place a pinch of salt on a baby's tongue during baptism and say, "Receive the salt of wisdom."

Salt was so valuable that caravans carried it across the Sahara to Eastern trading centers to exchange for gold, ivory, slaves and skins. Salt bars were the coin of the realm in Ethiopia for over a thousand years and cakes of salt stamped to show their value were also used as currency in countries from Borneo to Tibet.

How Did The Low Salt Crusade Start?

If salt was believed to be so valuable and useful in so many ways for so many thousands of years by so many million people from so many different cultures, why is it that we have only recently discovered that it is dangerous? Like the conspiracy against cholesterol and fat intake, the

denunciation of sodium began little more than 50 years ago. Low salt proponents point out that over four thousand years ago, the *Yellow Emperor's Canon of Internal Medicine* stated, "too much salt stiffens the pulse". They interpret this as representing advanced arteriosclerosis due to hypertension. However, unlike acupuncture, magnets and herbal remedies that are mentioned and are still popular, there was no further reference to this.

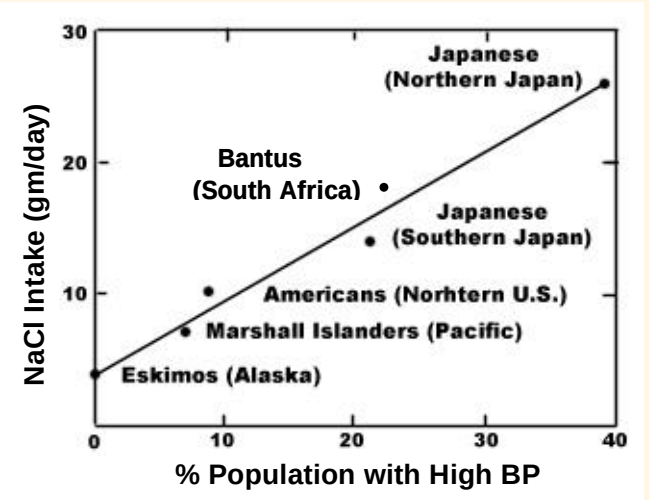
About 100 years ago, French physicians reported that restricting salt and salty foods benefited patients with fluid retention and hypertension. Shortly thereafter it was found that mercurial compounds used to treat syphilis often caused a significant diuresis, which led to the development of mercurial drugs to treat edema. Although more effective than trying to eliminate sodium intake, they had to be injected and often had serious side effects.

The advent of modern diuretics resulted from the equally serendipitous observation that some patients being treated with sulfa drugs for rheumatic fever and bacterial infections also often experienced a significant diuresis. In 1949, Bill Schwartz reported that three patients with marked edema due to heart failure who were given sulfonamides all showed dramatic improvement but that these drugs were also "too toxic for prolonged or routine use."

The first proof that reducing sodium intake could benefit some patients with hypertension also came in 1949 when Walter Kempner reported improvement in malignant hypertension associated with kidney disease and heart failure. The Kempner diet consisted solely of rice and certain fruits that limited sodium intake to less than 350 mg daily and had no fat. It was extremely hard to adhere to for more than a week or two but was preferable to bilateral lumbar sympathectomy, the only other treatment for this lethal disorder.

Karl Beyer, a research chemist, tried several variations of the sulfonamide formula and developed Diuril (chlorothiazide). It proved to be safer and more effective in reducing edema and it also lowered blood pressure in hypertensive patients without evidence of significant fluid retention. Diuril and other thiazide diuretics like Hydrodiuril and Hygroton quickly became the treatment of choice for hypertension. Support for their use came from animal studies showing a correlation between increased sodium content of arterial vessels and elevated blood pressure.

Lewis Dahl was able to develop a strain of salt sensitive rats that routinely developed hypertension to support his firm belief in the value of salt restriction. This was widely heralded and cited by other low salt proponents as proof of the role of salt in hypertension. What they often neglect to mention is that these rats would have to be fed an amount of salt equivalent to over 500 grams daily for an adult human. Dahl also demonstrated a linear relationship between salt intake and blood pressure in different populations as noted below:



This surely confirmed the dangers of salt for everyone and prompted the 1979 "Surgeon General's Report on Health Promotion and Disease Prevention" condemning salt as a clear cause of high blood pressure. Since then, the government has spent untold millions in a vain attempt to justify this claim. Their expensive and lengthy crusade to prove a link between sodium and hypertension began in 1984 with the $1.3 million INTERSALT study of 10,000 subjects in 52 centers around the world. As anticipated, researchers reported that societies with higher sodium intakes also had higher average blood pressures. A similar relationship was also allegedly shown in individuals, thus clinching the government's case.

The Art Of "Mining" Salt Study Statistics

The INTERSALT study seemed to confirm Dahl's findings. However, when the four primitive societies with both extremely low sodium intake and very low blood pressures were excluded no such correlation was found in the other 48 groups. This was reminiscent of Ancel Keys' famous study where he "cherry picked" seven out of 15 countries around the world and demonstrated a straight-line relationship between animal fat and cholesterol consumption and deaths from coronary heart disease. Had Keys selected data from the eight other countries that were available to him the results would have been exactly the opposite.

The INTERSALT researchers conveniently neglected to mention that the population of the four countries responsible for skewing the total figures to coincide with their preconceived conclusion also had less stress, less obesity, ate far less processed foods and much more fiber from fruits and vegetables. They also tended to die at younger ages from other causes and often too soon to have developed any significant degree of coronary atherosclerosis. Critics complained that these four societies that distorted the average figures for sodium intake and hypertension were so different from the rest of the groups, especially those in the U.S.A. and U.K., that it was "like comparing apples with stringbeans rather than oranges."

The Yanomami Indians in the rain forests of Brazil had mean blood pressures of 95/61 and equally low urinary sodium levels. These primitive people had no evidence of hypertension, obesity or alcohol consumption and their blood pressures did not rise with age. **When the available data from the other more civilized societies was reviewed, statisticians found that as sodium intake increased there was a decrease in blood pressure, just the opposite of what had been reported.** The lowest salt intake seemed to be in a subgroup of Chicago black males despite the fact that their incidence of hypertension was above average. Conversely, high blood pressure was relatively rare in participants from China's Tianjin Province even though this study group had the highest salt intake.

When confronted with these discrepancies, the researchers reanalyzed their data in an attempt to justify their conclusions. However, the only thing they could come up with was that a higher sodium intake could be correlated with a faster rise of blood pressure as people grew older. This is referred to as "mining the data" since a relationship between blood pressure and aging was never a goal of the study. Nor did this observation address the major purpose of determining whether increased dietary sodium was related to higher rates of illness or death for everyone.

While it may be true that "figures don't lie", liars can still figure. The first law of statistics is that if the statistics do not support your theory you obviously need more data. The second is that if you have enough data to choose from, anything can be proven by statistical shenanigans. A good example are the numerous "risk factors" for coronary heart disease like a deep earlobe crease or premature vertex baldness that are really "risk markers". These simply represent statistical associations rather than competent causes. **You can't use a statistic to prove another statistic.**

However, the anti-salt statisticians had a field day with the data from the 1999 follow-up study of NHANES (National Health and Nutrition Examination Survey) which began tracking 20,729 Americans in 1971. They reported that participants who ate the most salt had 32 percent more strokes, a whopping 89 percent more deaths from stroke, 44 percent more heart-attack deaths, and 39 percent more deaths from all causes. This finally seemed to prove precisely what the government had been preaching all along. In addition, the study's conclusions were seemingly credible due to the large number of subjects and a 19-year average period of observation, enough time to determine whether people would have increased mortality rates or a higher incidence of illness from consuming too much salt.

As the lead author proudly proclaimed, "Our study is the first to document the presence of a positive and independent relationship between dietary sodium intake and cardiovascular disease risk in adults".

Pouring Salt In Low Sodium Wounds

However, when independent researchers reanalyzed the data they discovered that **dietary sodium intake was associated with higher rates of illness and death only in participants who were overweight**. There was no correlation between sodium and increased cardiovascular disease risk in the remainder. Undaunted, another study author continued to claim that the conclusions were valid since statistics showed that more than one in three Americans were overweight and most ate too much salt.

He admitted that the NHANES research "was not specifically designed to answer" the question of sodium and health – in other words, more mining of the data. In addition, **the entire study depended on just one 24-hour recall of sodium intake**. When questioned about the dubious value of such information, he was forced to concede that "At best, the estimate for sodium is imperfect". He also agreed that measuring the concentration of sodium in a 24-hour urine specimen would have provided more accurate information about dietary habits and excess consumption.

Statistics are somewhat like expert witnesses in that they can be used to testify for either side depending on what you want to prove. When Michael Alderman, a highly regarded epidemiologist and past president of The American Society of Hypertension, scrutinized the same data in patients who were not overweight he reported that "**the more salt you eat, the less likely you are to die**." – (from heart disease or anything else). Alderman has long been critical of the government's low sodium diet advice for large populations and their focus on sodium intake as it relates to blood pressure rather than to the overall health, quality and length of life of individuals. He examined the relationship between sodium intake and health effects in 3,000 patients with mild to moderate hypertension. In addition, his group measured sodium excretion, which is much more accurate than estimating dietary intake. **At the end of four years, they found that those who consumed the least sodium had the most myocardial infarctions and other cardiovascular complications.**

The reason for this is that when you restrict vital nutrients like salt (or cholesterol) all sorts of strange things can result. Low sodium diets can increase levels of renin, LDL and insulin resistance, reduce sexual activity in men and cause cognitive difficulties and anorexia in the elderly. Tasteless and dull low sodium diets can cause other nutritional deficiencies. Lowering sodium with diuretics to treat hypertension can cause similar problems. Renin is possibly the most powerful and dangerous blood pressure raising substance known. Indeed, the study done by Alderman's group found that for every 2% increase in pretreatment plasma renin activity there was a 25% increase in heart attacks. No such correlation was found with increased sodium intake.

There are no research reports that justify putting everyone on a low-sodium diet. A meta-analysis of 83 published studies that included people who had been randomly assigned to follow a high or low sodium diet found that in those with elevated blood pressures, a low sodium diet was able to lower systolic pressure 3.9 mm Hg and diastolic pressure by 1.9 mm Hg. However, **in others with normal pressures, cutting salt intake reduced blood pressure by only 1.2 mm systolic and 0.26 mm diastolic**. I don't know how many of you have ever taken a blood pressure but it is almost impossible to detect such minute differences. If you use the standard method and take repeated blood pressures over a few minutes each reading often varies by 5 mm or more and it is extremely difficult to detect a diastolic measurement difference of 2 mm.

These figures were arrived at because meta-analysis is a technique that allows statisticians to look at studies that may have been designed for different reasons but contain data on specific items that can be combined and averaged for whatever purpose you choose. I have never been a great fan of meta-analysis, since it often illustrates that "statistics are a highly logical and precise method for saying a half-truth inaccurately." Low sodium diets may be helpful for some hypertensive patients by reducing their need for drugs but there is no proof to support official recommendations that they are good for everybody.

Slipping Through Some Legal Loop-holes

As previously noted, low salt diets may not be as entirely harmless as proponents often claim. In the meta-analysis survey, which was published in the *Journal of the American Medical Association* a few years ago, researchers reported that cholesterol and LDL "bad" cholesterol increased with sodium reduction. More importantly, blood levels of renin and aldosterone also rose in proportion to the degree of sodium reduction. This compensatory response to increase blood volume would tend to raise blood pressure and possibly the likelihood of cardiovascular complications. **Since the government began promoting sodium restriction and diuretics three decades ago, the incidence of hypertension and strokes has increased and the previous declining rate of heart attacks has leveled off.**

Investigators from the Salt Institute also wondered why there would be any dramatic rise with age if population blood pressures showed no association with dietary sodium intake. Because this was the only positive finding of the INTERSALT study they asked if an independent expert could analyze all the data, especially since this was a research project that had been funded by taxpayer money. The study authors refused claiming proprietary ownership and that this was only the first in a series of papers. It would also reveal confidential information about the study participants which, under INTERSALT's policies and alleged federal regulations, they were "obligated to protect from disclosure."

The NIH, which funded the study, was also petitioned but said that the financial arrangement had been structured specifically to exclude them from access to the raw data. This seemed strange. Sensing that some significant information was being withheld and mindful of the old saying that "the devil is in the data", the Salt Institute refused to be stymied. They asked the ORI (Office of Research Integrity) to determine whether the authors' findings had been fairly reported. ORI claimed they could only proceed if it was claimed that the authors had committed fraud - a Catch-22 situation, since it was impossible to make such an accusation without access to the raw data.

The Salt Institute then sought legal relief. The law requires that all federal guidelines affecting the public must be written and promulgated according to the Government Code. This mandates open meetings and discussions and that the final rules or guidelines must be published in the Federal Register. It took three years for their attorneys to finally obtain the raw data dealing with just one of several specific questions that had been posed. This was enough to bring down the house of cards. A detailed explanation of how the data had been manipulated to support predetermined conclusions was published in the *British Medical Journal* in 1996 and was subsequently endorsed by various authorities.

The NIH has consistently circumvented the Government Code with its cholesterol and hypertension guidelines by claiming they were written by outside experts not subject to these regulations, even though they are presented as official policy. The National Heart, Lung and Blood Institute, Department of Health and Human Services and U.S. Department of Agriculture have repeatedly referenced the INTERSALT study as justifying sodium restriction. The FDA even authorized a "sodium and hypertension" food label health warning that states, "The INTERSALT study reported a statistically significant relationship between sodium intake and the slope of systolic and diastolic blood pressure with age." How can anyone claim that this is not official policy?

In 1998, Congress mandated that federal agencies make available to the public all such data by broadening the Freedom of Information Act. It also included other provisions for the Office of Management and Budget to require all federal agencies to adhere to this new access-to-data standard. Unfortunately, this is not retroactive. Fifteen years later, we still do not have access to all the INTERSALT data and hundreds of studies started prior to 1998 are also exempt. Last month, a congressional bill was introduced mandating that the results of the more than $45 billion spent annually for research should be freely available to taxpayers. It would also prohibit all scientists who receive federal funding from holding copyright to their research. Don't hold your breath waiting for this bill to become law.

The DASH Study-Déja Vu All Over Again?

The NIH funded DASH (Dietary Approaches to Stop Hypertension) study reported in 1997 that blood pressure could be significantly reduced by eating a diet rich in fruits, vegetables and low-fat dairy products. This DASH combination diet was more effective than a typical American high fat, low fiber, low mineral diet and even one of fruits and vegetables, particularly in people with elevated blood pressures. All three diets had the same sodium content and there was no attempt to restrict salt. Government officials were anxious to show that restricting sodium would lower blood pressure even more.

This seemed to be confirmed in a follow-up DASH-Sodium study in 412 subjects with elevated and normal blood pressures that were randomly assigned to follow the DASH diet or a control typical American diet. The two groups were further divided into three categories: those who ate 3.3 grams of sodium/day (the amount in the average American diet); 2.4 grams/day (the current recommended level); and 1.5 grams/day. Researchers reported in May 2000 that reducing sodium intake from the high to low levels resulted in an average progressive lowering of systolic blood pressure of 6.7 mm Hg for those on the control diet and drop of 3 mm Hg for Dash Diet subjects. Hypertensive patients showed a greater response to a low sodium diet in both groups, with an impressive 11.5 mm Hg reduction for those on the control diet. Thus, sodium restriction lowered blood pressure in hypertensive and nonhypertensive men and women regardless of race. The belief that, "the lower the blood pressure the better", prompted the NHLBI director to declare that the four-decade-old controversy was now over. Everyone should adhere to a low sodium diet.

Not everyone agreed. The DASH diet was rich in calcium, potassium, and magnesium, all of which have been found to lower blood pressure. The study group was not representative of the American public and all meals had been prepared rather than selected. The available statistics suggested that for those on the DASH diet with normal blood pressures, cutting salt intake in half had little effect.

Diet was the most important influence and there was no significant additional benefit in hypertensives who also restricted salt. Participants were only followed for a month and prior studies had shown that any blood pressure reductions associated with restricting sodium tend to disappear after 6 months as compensatory mechanisms kick in. Since all subjects were fed prepared meals there was over 95% compliance, which would be difficult to achieve in a real life setting where people choose the foods they want to eat. Almost 60% of the subjects were African Americans and over 40% were hypertensive. Both of these groups tend to be salt sensitive and are hardly representative of the general population.

David McCarron, a hypertension specialist argued that the figures suggested that no benefits would be seen in white men under the age of 45, but here again, all the data were not available. As in the past, requests to release all the data were denied. McCarron complained about this in a letter to *The New England Journal of Medicine* and in a January editorial in the *American Journal of Hypertension*, which stated "critical data from a federally sponsored trial have been withheld." Nothing happened. On May 15, the Salt Institute and the U.S. Chamber of Commerce sought legal relief by invoking the Data Quality Act that took effect last October. This regulation now mandates that official agencies promulgating "influential" results that affect large groups must provide enough data and methods for a "qualified member of the public" to conduct a reanalysis. Since NHLBI's latest sodium restriction recommendations clearly affect a very large group of people and are based on the DASH-Sodium study, the argument that all subgroup data should be made available seems quite valid.

DASH authors will probably argue that they plan to publish more papers and, as noted in a response to McCarron's editorial, they are concerned that he will "dredge the data" and perform statistical analyses on groups that are too small to be meaningful. NHLBI has 60 days to respond but based on past experience, will likely continue to sidestep federal regulations and stonewall concerned scientists.

Should You Avoid Salt? Which Of Some 100 Blood Pressure Pills Is The Best For You?

What's the bottom line? Sodium restriction can benefit certain salt sensitive hypertensive patients and might possibly delay the development of high blood pressure in others. However, this does not apply to the general population, where no study has ever found an association between low-sodium diets and a reduced incidence of cardiovascular or other diseases. Average results from large study groups are not a useful guide to determine optimal treatment for a particular patient. A low fat diet can elevate cholesterol in some even though a mean decrease may occur in a population. **An eight-year study of New York hypertensives found that those on low-salt diets had more than four times as many heart attacks as controls with normal sodium intake.**

Unfortunately, there is no simple way to determine whether you are "salt sensitive" other than to go on a high sodium diet for a few weeks and then a low sodium diet to determine whether there is a significant change in blood pressure. The NIH recently invited applications for grants to develop an easily administered screening test for salt sensitivity. Several molecular markers have been proposed and Tulane researchers received a $6.5 million grant to identify genes that might be associated with salt-sensitive hypertension, but a simple and accurate test seems a long way off. The health consequences of salt sensitivity may not be limited to effects on blood pressure. One study showed a link with increased insulin resistance and another found that salt sensitivity increased mortality rates regardless of whether or not it was associated with hypertension.

There is growing recognition that hypertension is a complex metabolic disorder and that treatment efforts must be personalized and directed towards reducing its complications. This is quite different than simply attempting to lower elevated pressures to an arbitrary value based on large-scale study results. A good example is the ALLHAT trial, which concluded that the normal range for blood pressure should be lowered and a thiazide diuretic should be first line therapy for all hypertensives. There is good reason to believe that this could increase cardiovascular and other complications like diabetes. Some take the view that since most patients usually require more than one type of medication, a combination shotgun approach using minimal doses of diuretics, beta-blockers, calcium channel antagonists or drugs that affect the renin-angiotensin-aldosterone system is more practical. Others believe that 60% of hypertensives can be controlled on one drug and most others on two. John Laragh proposes that there are basically two types of essential hypertension: those that are low renin and salt sensitive (30%-35%) that respond to antivolume drugs like diuretics, and renin mediated hypertension (60-65%), which can now be treated with one of several antirenin medications based on renin profiling. The PRA (plasma renin activity) assay he and Sealey developed decades ago was very sensitive and labor intensive. The "Laragh Method" that now uses an automated and widely available direct renin assay seems to be the most logical approach to treat hypertension and reduce its complications. Stay tuned for more on this!

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