

Salt: I Can't Believe It's Still Controversial

Henry R. Black, MD, Lawrence J. Appel, MD, MPH | July 26, 2013

Introduction: Sodium and Hypertension

Henry R. Black, MD: Hi. I'm Dr. Henry Black, Clinical Professor of Internal Medicine at the New York University School of Medicine, former President of the American Society of Hypertension, and a member of the Center for the Prevention of Cardiovascular Disease at New York University.

I'm here today with my friend and colleague, Dr. Larry Appel, from Johns Hopkins University.

Lawrence J. Appel, MD, MPH: Thanks for inviting me to participate in this program. I'm Professor of Medicine and Professor of Epidemiology at the School of Medicine and the School of Public Health at Johns Hopkins University.

Dr. Black: Larry, I'd like to shift gears a little bit to a topic that I can't believe is still controversial, which is salt or sodium intake. First of all, when we all talk about it, we ought to make it very clear that we are talking about either salt or sodium. Don't use them interchangeably because the amount recommendations depend a little bit on the chemistry, which we learned in high school or college.

The recommended dietary intake of 1500 mg/day of sodium was recently challenged.^[1] What is your feeling about that? How did we get there, and what do you think we should be doing?

Dr. Appel: Let me take a few steps back and talk about the body of evidence that links sodium with health. There is a very robust body of evidence that was not reviewed in the part of the report from the Institute of Medicine that links higher sodium levels with higher blood pressure levels. The data are very robust; they are a combination of observational studies in which populations with extremely low sodium intake don't have problems with hypertension, and clinical trials in which reduced sodium intake resulted in substantial reductions in blood pressure.

The issue surrounding sodium is the challenge of doing high-quality research in this area. Because sodium is ubiquitous in the food supply, it is very challenging for individuals to reduce their intake.

The DASH Sodium Trial

Dr. Appel: In order to nail down the relationship between sodium and blood pressure, we had to do controlled feeding studies. These studies are very expensive, but they do result in clear answers. Perhaps the best one is a study called DASH-Sodium.^[2] It tested 3 different levels of sodium: roughly 1500 mg/day vs 2300 mg/day vs about 3500 mg/day. The 3500 mg/day is typical of what many Americans consume. The 2300 mg/day is close to the usual dietary recommendations, and 1500 mg/day is a level that was thought to provide additional benefit, but it is below the levels that are currently being consumed routinely. Not surprisingly, we found a progressive dose-response relationship: The higher the sodium intake, the higher the blood pressure. This was observed in 2 diets, the DASH diet and the typical American diet.

The DASH-Sodium trial was a very important study, and it addressed some of the methodologic issues that have plagued this field. It was a feeding study, which means that we provided food to the participants. We were able to provide 3 very distinct levels of sodium intake in a context of 2 different diets, the typical American diet and the DASH diet. We enrolled over 410 individuals and we fed them every meal that they ate for about 16 weeks. It was a rigorous trial and an expensive trial, but it provided unequivocal results that higher sodium intake means higher blood pressure. What was interesting -- and I think important and very relevant to the management of patients with hypertension -- is that the dose-response relationship was steeper between 1500 and 2300 mg/day, meaning that you got a lot of blood pressure reduction when you went down to the 1500 mg/day level. The results in certain subgroups -- African Americans and older-aged individuals -- were striking.

Dr. Black: We call them salt sensitive -- older people and African Americans.

Dr. Appel: For those individuals, there is a very good body of evidence to show that they are more sensitive. Those who are less sensitive still have a blood pressure response, but it's just not as much. Something to realize, of course, is that we all age, so we are going to end up in that higher age group where salt matters quite a bit and where people are also concurrently at higher risk for developing blood pressure-related cardiovascular disease.

The Challenge of Measuring Outcomes in Sodium Studies

Dr. Appel: The data, in terms of clinical trials, rest on blood pressure as an outcome. There are very few trials of sodium reduction in the general population with hard clinical outcomes downstream, and that is in part because of what I mentioned earlier, which is that sodium is ubiquitous. It is very difficult to maintain an experimental contrast and do a trial in which you could look at hard clinical outcomes. We have done secondary analyses of trials and we did see a signal in the general population, the best studies being the trials of hypertension prevention, where we saw about a 30% reduction for people who had been assigned to a reduced-sodium group.

Dr. Black: I think we have to realize that we can't always have a clinical trial in order to get answers, and we can't always wait for one. We have to use our judgment sometimes. It bothers me that anything but clinical trials isn't considered worthwhile, which is certainly not the case.

Dr. Appel: It's very difficult for clinicians to think that way -- especially with therapeutics, because you can actually test the hypothesis and do a clinical trial. I love those studies. Those are the studies that help guide policy and clinical practice. But when it comes to prevention, where you're talking about lifelong exposures, potentially exposures that started in childhood or maybe even in utero, they are just not amenable to clinical trials.

Why Is There Still Controversy Over Sodium?

Dr. Black: Larry, I agree with you and the body of evidence about the relationship between sodium or salt intake and blood pressure. We've seen blood pressure and outcomes. Why is there still so much controversy?

Dr. Appel: I mentioned earlier that the science dealing with sodium is plagued by methodologic issues. One of them, which I think resonates with clinicians, is the accurate measurement of sodium intake. I'm sure that you and others, myself included, have gotten 24-hour urine collections, and in order to actually assess whether somebody is consuming a large amount of sodium, you need to get several samples because there is so much day-to-day variation. That is impractical, so we often rely on a single one, especially in epidemiologic studies. But there are problems and I think we all recognize them. For the most part, the problem is incomplete collections.

I had a participant in one of my studies who provided a 24-hour urine in which the total sodium intake was 20 mmol. When she told me about her diet, she said it was a normal diet. She wasn't even trying to reduce her sodium intake. When you look at the urine creatinine, it turns out that there is evidence of incomplete collection. I can detect it, but in these large cohorts, you have contamination of the apparently low-sodium group, with people who are noncompliant with the collection method or, worse, what we call reverse causality. These are sick people who consume less of everything, and sodium is just one of them. Many of the observational studies that say that low sodium could be harmful are conducted in sick populations where the reduced sodium is a result of the condition, not the cause of the condition. That's a big problem.

Several studies have used convenience populations, meaning that people provided 24-hour urines but there was no quality control. Several of these were reviewed by the Institute of Medicine committee. Virtually every study has not put attention on the issue of collecting high-quality specimens. In studies where they tried to assure high-quality specimens, 20%-30% of individuals had to repeat their urine because of evidence of gross incomplete collections. If you don't deal with the issue of poor collection, you're going to get results that are biased or even paradoxical. You can't ignore the evidence, but it's very low-quality evidence.

Dr. Black: But it isn't just those studies. So much of what we know from animal studies and population studies points to this relationship, and it's amazing to me that it is still an issue. When we counsel patients with hypertension about what to do with lifestyle, I emphasize sodium. I see some patients who have lipid disorders whose problem may be the saturated fats they eat, but hypertensive patients ought to be focusing on how much sodium they eat, whether it's in the diet itself or whether it's potato chips and other snacks.

Dietary Sodium and Food Labels

Dr. Appel: What is very important is that in order to accomplish a reduced sodium intake, people have to be cognizant of the sources. Although you mentioned some of them, one of the key sources is cereal and bread products. That is where about a third to 40% of our sodium typically comes from. In aggregate, because they are consumed so frequently, they provide the largest amount of sodium that we consume.

Dr. Black: If you were to train a patient to read food labels, I think it's pretty easy to read the cholesterol and saturated fats. What do you tell them about the sodium on the food label?

Dr. Appel: One of the things to do is to look at food labels within a product series. If you're interested in prepared spaghetti sauces, you can get spaghetti sauces that have huge amounts of sodium (over 900 mg per serving), you can get ones that have about 300 mg per serving, and some have 50 mg per serving. It's important to look within a label class. Typically, I say to try to avoid any product that has over 300-400 mg per serving, because that will give you a big bang for the buck. In terms of cereals, I think you can aim for even less. You could aim for products that have less than 100 mg per serving. There are differences by food category.

The key to success is going to be changes by the food industry to reduce the amount of sodium that they routinely provide in their products, because it's not going to be by training 5 billion individuals to reduce sodium intake by reading food labels. The way we are going to accomplish sodium reduction is through changes in the food supply.

Dr. Black: As I understand it, that has been recently successful in the United Kingdom, thanks to Graham MacGregor, who has been able to influence food companies to gradually reduce the amount of sodium. People don't taste it after a while. I remember some classic studies from the 1970s where they gradually reduced the sodium that people ate, and within a month, foods that they used to like tasted too salty. I think that's the way we have to go. It is a key public health issue if we want to prevent strokes and other diseases.

Thank you very much, Dr. Appel. I really appreciated talking with you. I'll see you at a meeting soon.

Dr. Appel: Great. Thanks so much, Henry.

References

1. Institute of Medicine. Sodium Intake in Populations: Assessment of Evidence. May 14, 2013. Report brief. <http://www.iom.edu/Reports/2013/Sodium-Intake-in-Populations-Assessment-of-Evidence/Report-Brief051413.aspx> Accessed July 16, 2013.
2. Turban S, Thompson CB, Parekh RS, Appel LJ. Effects of sodium intake and diet on racial differences in urinary potassium excretion: results from the Dietary Approaches to Stop Hypertension (DASH)-Sodium trial. *Am J Kidney Dis.* 2013;61:88-95. [Abstract](#)

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