APPENDIX 1

100-YEAR TIME LINE COVERING THE IMPORTANT HISTORICAL EVENTS RELATING TO SALT AND SUGAR

1904 and 1905—Ambard and Beauchard are given credit for launching the salt–blood pressure hypothesis and the belief that hypertension is caused by a retention of salt.[1]

1907—Lowenstein did not confirm the benefit of a low-salt diet for hypertension.[2]

1920s—Beginning of the Salt Wars in the United States.[3]

1920/1922—Allen, Scherrill, and coworkers promote the idea that salt increases blood pressure in those with and without kidney disease.[4]

1929—Berger and Fineberg conclude that low-salt diets (less than 1 gram of salt per day) are ineffective for treating hypertension in almost three out of four patients with essential hypertension.[5]

1930–1944—Low-salt diets slowly fall out of favor for the treatment of hypertension.[6]

1944–1948—Kempner shows benefit of his Rice Diet (which was, among other things, low in salt).[7]

1945—Grollman is credited for confirming that it was the low-salt part of Kempner's Rice Diet that lowered blood pressure.[8] However, the study actually showed that not all patients benefited, others experienced harm (one patient actually died), and another patient experienced circulatory collapse (which was fixed by providing salt to the patient).[9]

1950s—Lewis Dahl and George Meneely begin to suggest that salt is important in hypertension and chronic disease.[10]

1950s—The beginning of a debate, largely between the ideas of Ancel Keys and John Yudkin, regarding saturated fat versus sugar as a cause of heart disease.[11]

1960—Lewis Dahl publishes a famous paper correlating higher sodium intake with a higher prevalence of hypertension in only five populations.[12] This graph is very similar to the evidence Ancel Keys used to demonize dietary fat as a cause of coronary heart disease back in 1953.[13]

1961—Keys's "diet-heart hypothesis" is accepted by the American Heart Association. The idea of too much saturated fat, not sugar, is embraced as the dietary culprit causing heart disease.[14] Consequentially, the AHA recommends restriction of animal fats and an increase in the intake of vegetable oils to reduce the risk of heart disease.

1966—Hall and Hall show that sugar has a hypertensive effect in rats.[15]

1972—The *New England Journal of Medicine* publishes a paper by John Laragh and colleagues, which states, "Plasma renin activity emerges as a potential risk factor for patients with essential hypertension." Additionally, the study showed that a lower sodium intake correlated with higher plasma renin activity.[16]

1974—Richard A. Ahrens publishes a review paper suggesting that sugar is a driver of hypertension and heart disease.[17]

1974—The Food and Nutrition Board indicates that there is little direct evidence that hypertension is produced in people with normal blood pressure on a normal-sodium diet.[18]

1975—Alexander Walker writes that there is no definitive data that a high-sugar diet is a driver of heart disease or hypertension. His research seemed to have partial grants from the sugar industry.[19]

1976—Edward Freis and Meneely and Battarbee publish influential review papers on the harms of salt.[20]

1977—The Dietary Goals recommend that all Americans restrict their salt intake to 3 grams per day.[21]

1978—A. E. Harper publishes a critique of the 1977 Dietary Goals showing that the evidence for low-salt diets in hypertensive patients was in-appropriately extrapolated to the general public and that a 3-gram daily salt intake was unrealistic and unattainable.[22]

1979—F. Olaf Simpson publishes a review paper that is skeptical of the benefits derived from a low-salt diet.[23]

1980—J. D. Swales publishes a review paper concluding that it was premature to recommend population-wide sodium reduction.[24]

1980—Preuss and Preuss show that sugar (without a high salt intake) increases blood pressure in rats with normal kidney function.[25]

1981—Yamori shows that as long as the Na/K ratio is less than 6 (despite a high sodium intake) in the Japanese, then the mean blood pressure is not hypertensive.[26]

1982—*Time* magazine releases its issue titled "Salt: A New Villain?"[27]

1983—Tessio Rebello and colleagues may have been the first to show that sugar significantly raises blood pressure in humans.[28] This was after we had vilified salt as the main dietary culprit causing hypertension.

1983—Robert E. Hodges and Tessio Rebello publish a review paper showing that sugar increases blood pressure in both animals and humans.[29]

1985—Boon and Aronson's review paper concludes that the amount of salt that needs to be restricted to obtain a measurable effect on blood pressure was intolerable for most patients.[30]

1988—Intersalt shows that when the four primitive societies were removed (leaving a total of forty-eight populations), a higher sodium intake did not correlate with a higher median blood pressure or prevalence of hypertension. Importantly, "body mass index had strong, significant independent relations with blood pressure in individual subjects."[31]

1989—Harriet P. Dustan states that there is no relation between blood pressure and salt depletion/salt loading, and that "salt-dependent hypertension" is not strictly controlled by salt intake but rather is probably controlled by aldosterone, norepinephrine, and epinephrine.[32]

1991—The first meta-analysis (which included nonrandomized and randomized trials) looking at sodium restriction and blood pressure is published.[33] Based only on reductions in blood pressure, the authors concluded, "Salt reduction by 100 mmol/24h would reduce mortality from ischaemic heart disease by an estimated 30 percent in the long term," and "A 50 mmol/24 h reduction in sodium intake would reduce the incidence of stroke by a fifth and that of ischaemic heart disease by a sixth."

1993—The Fifth Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC 5) cites the recently published 1991 meta-analysis to support sodium reduction.[34]

1995—Michael Alderman and colleagues publish a paper showing that "low urinary sodium is associated with greater risk of myocardial infarction among treated hypertensive men."[35]

1998—Niels Graudal publishes a meta-analysis of strictly randomized trials testing a low-sodium diet. The results found minimal reductions in blood pressure, whereas low-density lipoprotein (LDL) cholesterol, total cholesterol, noradrenaline, renin, and aldosterone were increased with a low-sodium diet. Their conclusion was, "These results do not support a general recommendation to reduce sodium intake."[36]

2001—The DASH-Sodium trial is published. This is a thirty-day randomized study that shows that reducing sodium intake may provide blood-pressure-lowering benefits.[37] However, it provided little benefit in those who had normal blood pressure and in those without hypertension who were forty-five years old and younger.[38] Additionally, there were increases in triglycerides, low-density lipoprotein (LDL), and total-cholesterol-to-high-density-lipoprotein (TC:HDL) ratio in those on the control diet when they restricted their salt intake.[39]

2002—Raben and colleagues show that a diet high in sugar significantly increases blood pressure in humans.[40]

2008—Brown and colleagues show that sugar raises blood pressure, heart rate, and cardiac output in humans, and that sugar increases blood pressure variability and myocardial oxygen demand.[41] These authors also show that sugar's antihypertensive effect occurs after its ingestion.

2010—Perez-Pozo and colleagues show that a high-sugar diet significantly increases twenty-four-hour ambulatory blood pressure in just a few weeks.[42]

2011—Stolarz-Skrzypek and colleagues publish a prospective population study concluding, "Lower sodium excretion was associated with higher cardiovascular disease mortality."[43]

2014—Malik and colleagues publish a systematic review of twelve studies (cross-sectional and prospective cohort) encompassing over 400,000 participants, showing that sugar-sweetened beverage intake is significantly associated with higher blood pressure and an increased incidence of hypertension.[44]

2014—Te Morenga and colleagues publish a meta-analysis of randomized controlled trials showing that a high-sugar diet significantly increases blood pressure versus a lower-sugar diet (the effect is around twice that found with altering sodium intake).[45]

2014—Adler and colleagues publish the most up-to-date Cochrane meta-analysis of randomized controlled trials indicating minimal reductions in blood pressure with a low-sodium diet and no significant reductions in all-cause mortality or mortality due to cardiovascular disease.[46]

2014—Graudal and colleagues publish a meta-analysis of twenty-three cohort studies and two follow-up studies of randomized controlled trials in 274,683 patients concluding that "compared with usual sodium intake, low- and excessive-sodium diets are associated with increased mortality."[47]

2015—Dietary Guidelines for Americans removed the severe limit on sodium intake (i.e., 1,500 milligrams per day), but the 2,300-milligram sodium limit remains.[48]

2016—Low sodium intakes are associated with an increased risk of cardiovascular events and death in those with or without hypertension, whereas high sodium intakes are associated with these harms only in hypertensive patients from a pooled analysis of four studies.[49]

2016—Patients without hypertension have no significant reduction in blood pressure with sodium restriction based on a meta-analysis of clinical studies.[50]

TIME LINE COVERING THE RECOMMENDATIONS FOR SODIUM INTAKE

1977—*1st Edition of the Dietary Goals:* set an upper intake of sodium at 1.2 grams (3 grams of salt).[51]

1977—*2nd Edition of the Dietary Goals:* set an upper intake of sodium at 2 grams (**5 grams of salt**).[52]

1980—*Dietary Guidelines for Americans*: "**use less table salt,**" avoid "pickled foods, salted nuts," "do not add salt to baby food," we "eat much more sodium than we need," and "the major hazard of excessive sodium is for *persons who have high blood pressure*."[53]

1985—*Dietary Guidelines for Americans:* "**avoid too much sodium.**"[54]

1990—*Dietary Guidelines for Americans:* "**use salt or sodium only in moderation.**"[55]

1995—*Dietary Guidelines for Americans:* **Daily Value for sodium is 2,400 milligrams per day (6 grams of salt).**[56]

2000—*Dietary Guidelines for Americans:* "**Healthy children and adults need to consume** only small amounts of salt to meet their sodium needs—**less than 1/4 teaspoon of salt daily**."[57]

2005—*Institute of Medicine (IOM):* introduces an **adequate intake** (AI) of 1,500 milligrams and **upper level** (UL) of intake of 2,300 milligrams for sodium.[58]

2005—*Dietary Guidelines for Americans:* All Americans should consume less than 2,300 milligrams of sodium (about 1 teaspoon of salt) per day[59] (based on the IOM report). "*Individuals with hypertension, blacks, and middle-aged and older adults.* Aim to *consume no more than 1,500 mg of sodium per day*."

2010—*Dietary Guidelines for Americans:* "*Reduce daily sodium intake to less than 2,300 mg* and further *reduce intake to 1,500 mg among persons who are 51 and older and those of any age who are African American or have hypertension, diabetes, or chronic kidney disease*."[60]

2015—*Dietary Guidelines for Americans:* remove the severe sodium restriction recommendation (i.e., 1,500 mg of sodium per day) but keep the recommendation that all Americans should restrict their sodium intake to less than 2,300 mg per day.[61]

TIME LINE COVERING THE RECOMMENDATIONS FOR SUGAR INTAKE

1977—*Dietary Goals 1st edition:* **15 percent added sugars**[62]

1977—*Dietary Goals 2nd edition:* **10 percent refined and processed sugars**[63]

1980—*Dietary Guidelines for Americans:* "*Contrary to widespread opinion, too much sugar in your diet does not seem to cause diabetes.*" And "**avoid excessive sugars.**"[64]

1985—*Dietary Guidelines for Americans:* "**Avoid too much sugar**" and "*contrary to widespread belief, too much sugar in your diet does not cause diabetes.*"[65]

1990—*Dietary Guidelines for Americans:* "**Use sugar only in moderation**" and "Diets high in *sugar have not been shown* to cause diabetes."[66]

1995—*Dietary Guidelines for Americans:* "**Choose a diet moderate in sugars.**" It's as if the guidelines want us to eat added sugar.[67]

2000—*Dietary Guidelines for Americans:* "**Choose beverages and foods to moderate your intake of sugars.**" This is the first time that the Dietary Guidelines no longer state that "sugar doesn't cause diabetes" or that "there's no proof sugar causes diabetes."[68]

2002—*Institute of Medicine (IOM):* allows for 25 percent of total calories to come from added sugars.[69]

2005—*Dietary Guidelines for Americans:* 267 calories of "discretionary" calories (coming from added sugars and/or solid fat) are allowed; this would be only **67 grams of added sugars** (267/4 calories per gram of sugar = 67). However, it states that **up to 72 grams of added sugars are allowed**.[70] ("If fat is decreased to 22 percent of calories, then 18 teaspoons [72 g] of added sugars is allowed.")

2010—*Dietary Guidelines for Americans:* **technically up to 19 percent of total calories can be ingested from added sugars** if someone consumes 3,000 calories per day (the guidelines don't specifically state this, but if no solid fats are ingested, then 19 percent of calories from added sugars may be consumed).[71]

2015—*Dietary Guidelines for Americans:* finally recommends that added sugars should make up no more than 10 percent of total calories.[72]

APPENDIX 2

DRUGS THAT CAN INCREASE NEED FOR SALT

Hypovolemic hyponatremia can be caused by thiazide and loop diuretics, sodium-glucose cotransporter 2 (SGLT2) inhibitors (like dapagliflozin) used to treat diabetes, salt-wasting nephropathies such as renal tubular acidosis, polycystic kidney disease and obstructive uropathy, medications like cyclosporine and cisplatin,[1] or conditions like sepsis.[2] Other medications that can cause hyponatremia include oxcarbazepine, trimethoprim, antipsychotics, antidepressants, NSAIDs, cyclophosphamide, carbamazepine, vincristine and vinblastine, thiothixene, thioridazine, other phenothiazines, haloperidol, amitriptyline, other tricyclic antidepressants, monoamine oxidase inhibitors, bromocriptine, clofibrate, general anesthesia, narcotics, opiates, ecstasy, sulfonylureas, and amiodarone.[3]

APPENDIX 3

SALT CONTENT OF FAVORITE FOODS

You can check the salt content on the label of your favorite foods to give yourself a sense of how much salt you're craving—this is useful information for getting acquainted with your salt thermostat—but don't count milligrams per day. Your body will guide you to the right intake. The following list provides the salt content of some common foods.

Food	Sodium Content
Frozen dinners	Up to 1,800 mg per meal
Canned soups and vegetables	Up to 1,300 mg per serving
Cottage cheese	~1,000 mg per cup
Spaghetti sauce	Up to 1,000 mg per cup
Sandwiches	Up to 900 mg per sandwich
Pickles	Up to 785 mg per pickle
Instant beef noodle soup	757 mg per packet
Roasted and salted pumpkin seeds	Up to 711 mg per ounce
Hot dog	Up to 700 mg per hot dog
Tomato juice	Up to 700 mg per 8 ounces
Teriyaki sauce	690 mg per tablespoon
Roquefort cheese	507 mg per ounce

Pretzels	480 mg per ounce
Bagel	~460 mg per bagel
Veggie burger	400–500 mg per patty
Soy sauce	409 mg per teaspoon
American cheese	400 mg per ounce
Salad dressing	Up to 300 mg per 2 tablespoons
Capers	255 mg per tablespoon
6-inch tortilla	~200 mg
Cereal	180 to 300 mg per serving
Cured bacon	175 mg per slice
Ketchup	150 mg per tablespoon
Spinach	125 mg per cup
Sweet relish	122 mg per tablespoon
Beets	65 mg per beet
Celery	50 mg per large stalk of celery
Carrot	50 mg per large carrot

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CHAPTER 4: WHAT *REALLY* CAUSES HEART DISEASE?

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CHAPTER 5: WE ARE STARVING INSIDE

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CHAPTER 6: CRYSTAL REHAB: USING SALT CRAVINGS TO KICK SUGAR ADDICTION

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CHAPTER 7: HOW MUCH SALT DO YOU REALLY NEED?

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CHAPTER 8: THE SALT FIX: GIVE YOUR BODY WHAT IT REALLY NEEDS

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ABOUT THE AUTHOR

James DiNicolantonio, PharmD, is a cardiovascular research scientist and doctor of pharmacy at Saint Luke's Mid America Heart Institute in Kansas City, Missouri. A well-respected and internationally known scientist and expert on health and nutrition, he has contributed extensively to health policy. He has published over two hundred scientific papers in the medical literature. Dr. DiNicolantonio has testified in front of the Canadian Senate on the drivers of obesity and the harmful effects that refined carbohydrates and sugar have on our health. He has published numerous high-profile articles on nutrition in the lay press, including the *New York Times*, *Forbes*, and *U.S. News & World Report*. He serves as the associate editor of *BMJ Open Heart*, a journal published in partnership with the British Cardiovascular Society. He is also on the editorial advisory board of several other medical journals, including *Progress in Cardiovascular Diseases*, *Journal of Insulin Resistance*, and *International Journal of Clinical Pharmacology and Toxicology*. He lives in Fairport, New York.