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The Imbalance of Sodium and Potassium Intake: Implications for Dietetic Practice

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Americans are consuming too much sodium and too little potassium. Decreasing sodium intake and increasing potassium intake can reduce the risk of high blood pressure, heart disease, and stroke, and can help control blood pressure. Registered dietitians (RD's) may play a role in preventing disease by counseling clients about the importance of reducing sodium intake and increasing potassium intake. This paper discusses the impact of sodium and potassium intake on health and explains the role of the registered dietitian nutritionist (RDN) when counseling clients about reducing sodium intake and increasing potassium intake.

AMERICAN INTAKE OF SODIUM AND POTASSIUM

Currently, about 90% of Americans consume excess sodium¹ and virtually everyone consumes inadequate potassium.² Randomized Control Trials and epidemiologic studies have demonstrated that higher sodium intake and lower potassium intake are modifiable risk factors for elevated blood pressure and hypertension,^{3–11} in addition to excess body weight, non-adherence to a Dietary Approaches to Stop Hypertension (DASH) eating plan, lack of physical activity, and excess alcohol consumption.¹² Non-modifiable risk factors include age and family history.¹² High blood pressure is a leading risk factor for heart disease and stroke which are both leading causes of death in the United States.¹³ Reducing sodium intake and increasing potassium intake has been found to lower blood pressure. Further, higher intakes of potassium can attenuate the adverse effects of sodium on blood pressure, especially at high rather than low levels of sodium intake.¹¹ Other benefits of increased dietary potassium intake include a reduced risk of developing kidney stones and decreased bone loss.¹⁴

About 90% of sodium added to processed foods is in the form of sodium chloride (salt).¹¹ Potassium is added to processed foods and supplements as potassium chloride. Potassium is also found inherently in foods as potassium citrate and to a lesser extent as potassium phosphate. Unlike potassium chloride, inherent forms of potassium favorably affect acid base balance as bicarbonate precursors.¹⁴ While clinical trials indicate that potassium chloride intake can reduce blood pressure,^{15–17} observational trials indicate that inherent sources of potassium (mainly from sodium bicarbonate) may also prevent bone loss and cardiovascular disease (CVD).¹¹

Recommended Intake

The *2010 Dietary Guidelines for Americans* recommend Americans age 2 years and older 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.¹⁸ Average sodium intake for Americans ages two and older is currently much higher; about 3,400 mg per day excluding salt added at the table.¹⁹ Recent research found that 79% of children aged 1–3 years and 87% aged 4–5 years also consume too much sodium, with an average intake of 2,504 mg per day for the older group. According to the study, black children aged 1–5 years consume more sodium than children in any other racial or ethnic group.²⁰ The Institute of Medicine recommends that Americans age 14 and older consume 4,700 mg of potassium daily,¹¹ however current intake by all age groups is considerably lower; approximately 2,600 mg per day.¹⁹ Among children, aged 1–5, less than 10% are consuming enough potassium each day.²⁰ Similar to sodium, blacks and people with hypertension are more responsive to variations in potassium intake compared to their nonblack and non-hypertensive counterparts.¹¹

Food Sources

While both sodium and potassium are naturally present in a variety of foods, more than 75% of sodium intake is from sodium added to processed foods.²¹ Only 10 food categories: bread and rolls, cold cuts/cured meats, pizza, fresh and processed poultry, soups, sandwiches (such as cheeseburgers), cheese, pasta mixed dishes (eg, spaghetti with meat sauce), meat mixed dishes (eg, meat loaf with tomato sauce), and savory snacks (eg, chips and pretzels), contribute nearly 44% of sodium intake.²² Natural sources of potassium are most notably found in vegetables, fruits, and milk and milk products. However, in 2010, the top five food category contributors to potassium were reduced fat (2% and 1%) milk, coffee, chicken and chicken mixed dishes, beef and beef mixed dishes, and 100% orange/grapefruit juice.²

The Sodium-Potassium Ratio

Emerging research indicates that the ratio of sodium to potassium intake is a greater risk factor for hypertension and CVD than either electrolyte alone,^{10,23–26} however the ideal sodium to potassium ratio has not yet been defined. A recent analysis by Yang and colleagues²⁷ found that a higher ratio of sodium to potassium is associated with significantly increased risk of CVD and all-cause mortality. The average ratio of sodium to potassium for adults aged 20 years has been found to be 1.41; the ratio of sodium to potassium is also significantly associated with systolic blood pressure.²⁸ According to the Institute of Medicine, the median ratio of sodium to potassium under 1 year of age is less than one, rises throughout childhood and adulthood, and then drops slightly in middle- and older-aged adults.¹⁴ The steady rise in the ratio of sodium to potassium starting at an early age reflects an increase in sodium intake and decrease in potassium intake resulting from a Western diet heavily reliant on processed foods high in added sodium and low in added potassium.¹⁴

IMPLICATIONS FOR DIETETICS PRACTICE

While sodium is a required nutrient to be listed on the Nutrition Facts label, labeling of potassium is voluntary.²⁹ Further, many food sources of potassium such as fresh fruits and vegetables are not required to bear any nutrition label. Packaged foods that meet nutrient criteria for “low sodium” and are considered a good source of potassium can bear the health claim: “Diets containing foods that are good sources of potassium and low in sodium may reduce the risk of high blood pressure and stroke.”³⁰ Foods that bear this claim are required to list potassium content on the food label. Encouraging clients to consume a greater variety of foods containing inherent sources of potassium, such as bananas, potatoes and sweet potatoes, low- and no-fat yogurt, dried apricots, spinach, and dried or no salt added/low sodium canned beans (other than green beans) can assist in decreasing sodium intake while increasing intake of natural sources of potassium.

Sodium content can vary significantly across different brands of the same product. For example, chicken noodle soup can vary in sodium by as much as 840 mg per serving.³¹ Counseling patients on reading nutrition labels and choosing foods lower in sodium, as well as seeking out foods labeled “low sodium”, “no salt added”, or that bear the health claim for sodium and potassium can help patients reduce sodium intake. In addition, research has found that consuming a diet consistent with the DASH diet can help lower blood pressure while providing nutrient adequacy for sodium, potassium, and other nutrients. Studies have found that daily DASH diets containing 2,300 mg of sodium can lower blood pressure and DASH diets meeting 1,500 mg of sodium can further reduce blood pressure.³² However, adults with self reported diabetes and hypertension have been found to have higher sodium intake (153% of DASH target vs. 146.6%) compared to those without either condition.³³ Ethnicity also impacts adherence to a DASH diet, with research indicating that blacks are less adherent to the DASH diet compared with whites.³⁴

Potassium chloride is increasingly used as a salt substitute or as a component or ingredient of a “lite salt”; efforts to reduce sodium intake may increase the reliance on potassium chloride as a salt substitute in the food supply.³⁵ Although potassium intake recommendations encourage increased potassium intake, these recommendations are made for the generally healthy population. Persons with medical conditions such as diabetes, chronic kidney disease, end-stage renal disease, severe heart failure, and adrenal insufficiency, individuals with impaired urinary potassium excretion, and individuals taking medications that result in an increase in serum potassium, such as angiotensin-converting enzyme inhibitors and potassium-sparing diuretics may not benefit from increased potassium intake.² RDNs can assist patients and clients in determining if a potassium chloride-based salt substitute is right for them based on current medication use and disease history.

While the current food supply can cause difficulty in meeting sodium intake recommendations, gradual reductions of sodium in the food supply over time will make this more feasible, while allowing greater choice for consumers. According to recent research, approximately six in 10 Americans regularly purchase or would purchase reduced/lower sodium foods;^{36,37} however, the majority report limiting added salt to food as their primary means of reducing sodium intake. RDNs can help bridge this knowledge gap through

counseling patients and clients on the major sources of sodium (processed food), stressing the importance of comparing food labels and choosing foods lower in sodium as a means to reduce intake, and offering strategies to adhere to the DASH eating plan. RDNs can assist patients with understanding and overcoming adherence barriers to the DASH eating plan, and assist other health professionals by communicating successful strategies their patients have used to overcome adherence barriers.

Although blood pressure is more greatly affected by a joint decrease in sodium and increase in potassium, this combination is difficult given the current food supply. While consumers can choose to consume more potassium-rich foods, the amount of sodium currently in the food supply makes sodium reduction more challenging. Future research could assess the ratio of sodium to potassium given the impact on blood pressure. Patient education by RDNs supporting decreased sodium intake and increased potassium intake would also be beneficial, especially for black and hypertensive populations.

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