

by Andrea Rosanoff & Roger Clemens

Managing Magnesium in a Sodium-Dominant Era

Healthcare professionals may not realize it, but their frequent admonition to “cut out the salt” may be a plea for lower sodium-to-potassium (Na:K) and sodium-to-magnesium (Na:Mg) ratios in a patient’s diet. Some of these professionals contend that few, if any, formulated food products provide sufficient magnesium and potassium to balance the sodium from added salt, regardless of its function or purpose. In fact, the health consequences of these mineral inadequacies and

increased 50-fold.

The top contributors to dietary potassium are reduced-fat milk; coffee; chicken and chicken mixed dishes; beef and beef mixed dishes; and 100% orange/grapefruit juice. On the other hand, the primary contributors to dietary magnesium include fruits, vegetables, and whole grains. Usual daily intake data from the U.S. Dept. of Agriculture (USDA) indicate the majority of Americans consume less than the recommended amounts of fruits and vegetables.

adequate cellular energy in the form of Mg-ATP, which is itself produced in continuous metabolic reactions requiring several magnesium-dependent enzymes. Importantly, when there is insufficient cellular magnesium, there will not be adequate energy to maintain the constant sodium-potassium pump process even when nutritional potassium is balanced relative to sodium. In addition, normal detoxification processes, including phase I and phase II reactions, that occur in

such as food safety, process functionality, and flavor. It may be that despite these important functions, these products may be “unbalanced” in sodium relative to both potassium and magnesium. Of course, these minerals can have a significant impact on product sensory qualities without addressing further considerations on nutrient composition, formulation demands, technology limitations, and regulatory constraints. Balancing the sodium with more potassium and magnesium (and

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possible imbalances can be significant. These inadequacies may contribute to cardiovascular problems and related co-morbidities (Cooper, 1996; Rosanoff and Seelig, 2003; Ohira et al., 2009). “Balanced sodium” may be a more appropriate nutritional health concept behind the great challenge for many of today’s food scientists and nutritionists: development of low- or reduced-sodium foods that taste great!

NHANES 2005–2006 data indicate that none of the U.S. population consumes an adequate amount of potassium. The same data set indicates that more than 50% of adults do not ingest adequate magnesium. Of considerable interest is that over the past century, our dietary sodium:potassium ratio has increased 75-fold and our sodium:magnesium ratio has

It also appears that virtually none of the American population consumes an adequate level of whole grains. These foods are naturally low in sodium and good sources of both potassium and magnesium. In addition, refined flour and cereals, which provide about 25% of our daily energy intake, are very low in sodium and enriched with four B-vitamins and iron, yet, according to the USDA Nutrient Database, are almost 70% lower in potassium and 80% lower in magnesium than whole wheat flour and cereal grains.

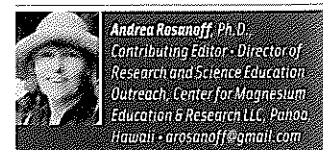
Considerable cellular energy is required, along with magnesium-containing enzymes, to balance electrolytes by constantly pumping sodium out of cells and pumping potassium into cells. This energy-consuming process maintains the gradient vital to life function, and is dependent upon

the liver may be compromised. For example, many individuals over age 65 are on multiple medications while consuming low levels of magnesium. Among widespread medications, statins lower LDL cholesterol by inhibiting the rate-limiting enzyme HMG CoA Reductase, which is naturally controlled by magnesium (Rosanoff and Seelig, 2004). Diuretics for hypertension increase urinary loss of both potassium and magnesium, while other anti-hypertensive medications such as beta-blockers and ACE Inhibitors, appear to “spare” physiological magnesium, perhaps accounting for their ability to lower high blood pressure (Rosanoff, 2010). At any rate, magnesium is critical for the adequate metabolism and clearance of these substances.

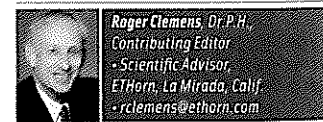
Many processed foods contain sodium for multiple purposes,

quite possibly the other major and trace minerals) may be the prudent approach to maintain long-term, healthy sodium-potassium-magnesium relationships. McCarron (1997) contends that humans with high potassium and magnesium intakes can healthfully handle liberal salt diets and are among the healthiest of people. **FT**

References cited in this article are available from the authors.



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