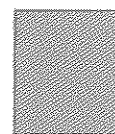


Desalting the Food Grid

Product developers are responding to public health concerns about the sodium content of processed foods. What sodium-reduction tactics are they using?



Bread, cereal, frozen pizzas and entrées, processed meats, shelf-stable soups and sauces, pasta, and salty snacks comprise the daily dietary intake of most consumers. To supplement the convenience of such easy-to-prepare foods stocking the refrigerators, freezers, and pantries of consumer homes, some consumers also dine regularly at chain restaurants. Since the 1970s, the sodium content of restaurant and processed food has escalated along with steady increases in portion sizes. As a result, Americans now consume in excess of 3,400 mg of sodium every day, exceeding the recommended daily allowance of 2,300 mg, which is less than a teaspoon of salt. More than 70% of that excessive sodium intake comes from restaurant and commercially processed foods.

The human body needs a moderate amount of sodium to facilitate the absorption of major nutrients; the proper functioning of cells, nerves, and muscles; and the

maintenance of an adequate balance of water and minerals. Thus, some sodium is essential for optimal health. But the excess sodium consumers receive daily is strongly linked to elevated blood pressure, which increases the risk of heart disease, stroke, and kidney disease—respectively, the first, third, and ninth leading causes of adult deaths in the United States. Because of these grim statistics, public health campaigns, government officials, and advocacy groups strongly urge consumers to reduce their intake of sodium-rich food.

Information on the amount of sodium in restaurant entrées is usually not readily available—and virtually impossible for consumers to estimate—but food manufacturers routinely include the sodium content of all packaged processed foods in the Nutrition Facts panel on labels. Far too frequently, the amount of sodium listed on processed-food labels is startling: Many products contain greater than half the recommended daily sodium

allowance in a single serving.

Sodium's Role in Processed Foods

Although the sodium content of processed foods may be high, food manufacturers would likely make the case that the amount of sodium in processed foods is not arbitrary. First, many foods naturally contain some sodium. Second, salt—the main source of sodium in processed foods—plays an integral role in food processing and food safety: It enhances the flavor of foods, unveiling a food's natural flavor, masking bitterness and acidity, and even making sweets taste sweeter. Salt regulates the fermentation of yeast in baked goods and alcoholic beverages and is useful in the manipulation of the aroma, color, and texture of food. Perhaps more importantly, salt and other sodium-containing ingredients (see Table 1) preserve food and retard microbial growth, thereby extending the shelf life of perishable items.

Clearly, sodium is as essential to food processing as water is to gardening, which means that reducing sodium in processed foods is not so straightforward. In fact, the

Combinations of herbs and spices are virtually endless and constitute a flavorful alternative to salt.

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Table 1. Sources of sodium (other than salt) in processed foods.

| Ingredient/Additive | Usage |
|----------------------------------|-----------------------------------------------------------------------|
| Baking powder | Leavens breads and cakes |
| Disodium phosphate | Prevents caking of powdered products |
| Monosodium glutamate | Adds savory flavor to various foods |
| Sodium alginate | Increases viscosity and emulsifies liquids |
| Sodium benzoate | Preserves condiments such as salad dressings and sauces |
| Sodium bicarbonate (baking soda) | Leavens breads and cakes |
| Sodium hydroxide | Softens and loosens the skin of certain fruits and vegetables |
| Sodium nitrate | Cures meats and sausages |
| Sodium nitrite | Cures meats and sausages |
| Sodium propionate | Inhibits the growth of molds in pasteurized cheeses and baked goods |
| Sodium sulfite | Preserves dried fruits and bleaches fruits to be artificially colored |

Institute of Medicine recommends an incremental approach to reducing sodium in foods and beverages until research demonstrates that such reductions will have no adverse impact on public health. Also, variations in taste and consumer

soup is the most challenging because it has the most complex flavor profile for taste, and salt is an amazing potentiator of taste." Each soup within Campbell's *Healthy Request*® line of soups has up to 50% less sodium than regular soups, and 45

including cereal, soup, and savory snacks.

After a two-year initiative, Bumble Bee Foods recently introduced canned tuna and salmon products with less sodium. The company trimmed sodium by 44% in its albacore products, by 28% in its line of chunk light tuna, and by 25% in its salmon products. "While sodium levels were already low in our tuna and salmon products, we took this opportunity to make our already healthy products even healthier," says Dave Melbourne, Senior Vice President of Bumble Bee Foods. The company continues to explore strategies to reduce sodium in other products within its portfolio: "We are continuing to identify further sodium reduction opportunities across the entire Bumble Bee product line. We're targeting a weighted average of 15% reduction by 2015 and a 22% reduction by 2020," Melbourne states.

The methods food companies use to reduce sodium vary. Some

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acceptance are significant concerns for the food industry. Nevertheless, food manufacturers appear to have embraced the movement.

Food Companies Take Action

Campbell Soup Company has been gradually reducing sodium in soups and beverages since the early 1980s. In 2009, Campbell introduced a lower-sodium version of its iconic condensed tomato soup, reducing the sodium content by 32%. Sodium reductions of other popular versions of Campbell's condensed soup are underway: This summer "more than 20 soups in our condensed soup line will be released with reduced sodium," says Bill Bangs, Senior Research Fellow at Campbell Soup Company. "We have over 200 products that are reduced in sodium, so it's not just soup. But

of Campbell's condensed soups will soon have 25% to 45% less sodium. Other Campbell brands that include products with reduced-sodium profiles are *SpaghettiOs*® pasta, *Prego*® sauces, and *V8*® juices.

Likewise, General Mills has been quietly reducing sodium in some of its products since 2005. "While salt and sodium are functional, we are committed to lowering sodium in products where we can make a meaningful change. Reductions have already been implemented successfully on a number of products, including a 16% sodium reduction in *Cheerios*® and *Honey Nut Cheerios*®," says General Mills spokesperson Heidi Geller. The company intends to expand its sodium reduction strategy, which will involve a 20% decrease in sodium in 40% of its product line,

plan simply to reduce the amount of salt in their products, achieving a barely perceptible or nonexistent difference in taste over time. Earlier this year, Kellogg's announced its plan to reduce the level of salt in brands such as *Corn Flakes*® and *Rice Krispies*® products without using any salt replacement ingredients. However, many manufacturers would rather avoid this technique out of concern that even the slightest change in taste perception could upset consumer loyalty.

Other companies reformulate recipes, using various methods. Campbell's sodium-reduction strategy involves using a combination of tactics: "Campbell's has a strategy for getting all of our products down to a healthy level of sodium. We are using naturally sourced ingredients such as sea salt and herbs & spices,

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Campbell's low-sodium chicken noodle soup is one of 45 condensed soups with 25% to 45% less sodium.



but we are working with ingredient companies as well," says Bangs, who oversees Campbell's development of reduced-sodium products. Bumble Bee has a similar approach: "To date we have removed added salt from our formulations. The next phase of our sodium reduction is to develop salt replacements from blends of potassium and sodium chloride, sea salts, or flavorings/spices for our formulated products," Melbourne says. Hence, for manufacturers seeking consistency in the taste and quality of their products, amending recipes to produce reduced-sodium foods predominantly involves making use of sea salt, herbs & spices, innovative salt replacement technologies, and taste enhancers.

Sea Salt and Herbs & Spices

In general, the term sea salt refers to the grains obtained from the natural evaporation of seawater. Unlike table salt, sea salt undergoes little or no refining techniques, which allows it to retain natural traces of other minerals, including iron, magnesium, calcium, potassium, and iodine. These trace minerals are presumably the reason sea salt is often marketed as more flavorful and healthier than table salt.

Another claim made of sea salt is

that less of it is necessary to achieve the same seasoning result as table salt. Although there are differences in flavor and texture between sea salt and table salt, the two contain virtually the same amount of sodium. In fact, the Food Standards Agency of the United Kingdom says that when it comes to sodium content, sea salt is no better for consumers than table salt (FSA, 2010). Morton Salt, which offers a variety of food-grade sea salt products, has a slightly different view: "There are some sea salt products that have been processed to reduce the sodium content. However, many sea salt products do not contain significantly less sodium compared to regular salt," says Linda Kragt, Technical Services Manager at Morton. Thus, replacing table salt with sea salt in recipe formulations may add unique variations in flavor but will not necessarily lessen the sodium content of food products.

The ubiquity of world cuisines has introduced consumers to an abundance of flavors based on ingredients other than sea salt. Herbs such as basil, cilantro, garlic, thyme, bay leaf, rosemary, and sage or spices such as chili pepper, cinnamon, cumin, curry, ginger,

nutmeg, star anise, and tarragon not only impart distinctive flavors, aromas, and color but also play a role in food safety. Certain herbs & spices possess antimicrobial properties and have been used throughout history to preserve perishable foods. In fact, researchers at Cornell University determined that allspice, garlic, onion, and oregano were the most potent in retarding the growth of foodborne bacteria, inhibiting their growth by 100%. In ascending order, mustard seed, marjoram, rosemary, chili pepper, bay leaf, lemon grass, cloves, cumin, tarragon, cinnamon, and thyme inhibited the growth of foodborne bacteria by 75% or more (Sherman and Billing, 1999). Moreover, the combinations of herbs & spices are virtually endless and are applicable to every food and food product for breakfast, lunch, and dinner.

Potassium Chloride

According to the Grocery Manufacturers Association, potassium chloride is one of the most common ingredients used as a substitute for salt in processed food (GMA, 2008). A metal halide salt, potassium chloride has a crystalline structure similar to table salt and has no odor in its purest state. Perhaps its biggest benefits are that it provides the all-important salty flavor as well as "similar physical properties to sodium chloride, exerting important functional effects such as moisture retention, texture improvement, and shelf-life extension," Kragt says.

On the other hand, potassium chloride is known to possess a bitter or metallic aftertaste, but more importantly, some consumers cannot consume potassium chloride safely. Like excess sodium, excess potassium exacerbates certain existing health issues such as kidney or heart problems and diabetes, and it can interfere with blood pressure medications. For these reasons, a direct one-to-one swap of potassium chloride for sodium chloride

presents somewhat of a conundrum. "In most foods, potassium chloride alone cannot substitute for all of the salt in [a] product," Kragt confirms. A solution may lie in proprietary blends of regular salt and potassium chloride combined with masking or modifying technologies.

"We've had great success masking the metallic notes of potassium chloride. With *KCLEan™ Salt*, we've been able to achieve a one-to-one replacement, translating to a 50% reduction in sodium," says Leda Strand, Director of Technology Applications and Industrial Ingredients at Wixon Inc. *KCLEan Salt* combines a flavor-modifying technology with both sodium chloride and potassium chloride. The flavor modifier, *Mag-nifique Mimic™*, removes the bitter aftertaste of potassium chloride while maintaining an all-natural profile. The result is a salt substitute that has the look, texture, and taste of regular salt but with half the sodium. *KCLEan Salt* is heat stable and can be used in products such as baked goods, cereals, cheese, soups, sauces, and snack foods.

SaltTrim®, by Wild Flavors Inc., blocks the bitter and metallic aftertastes of potassium chloride while maintaining a true salty taste. Designed to be used with food manufacturers' own potassium chloride application, the product can facilitate up to a 50% reduction of salt in recipes. For food manufacturers looking for clean-label ingredients, *Sea SaltTrim®* combines the *SaltTrim* taste modulator with a sea salt containing an inherent level of potassium chloride. Both ingredients are suitable for sodium reduction in a variety of applications, including bread, cheese, soup, salad dressing, and processed meat.

Another product that mitigates the negative aftertaste of potassium chloride is *ReduxSo™*, a sodium-reducing system by Bell Flavors & Fragrances that contains potassium chloride. Frequently used by food manufacturers in meat and snack foods, *ReduxSo* "is just as functional as salt and is highly useful in meat systems that rely on salt for protein extraction," according to Christopher Warsow, Corporate Executive Chef at Bell. Available in powder and liquid forms, *ReduxSo* delivers a salty taste yet reduces salt content by up to 50% in food products.

Taste Enhancers

Taste enhancers are food additives that augment the taste of certain foods by activating receptors in the mouth and throat. With little or no flavor of their own, taste enhancers counter the effects of reduced salt in food, placing particular emphasis on umami taste receptors. Umami, one of five primary tastes (the other four are bitter, salty,

sour, and sweet), describes a flavor that is savory and full-bodied, and research has determined that it can affect the perception of saltiness in foods (Mojet et al., 2004). Common taste enhancers that food manufacturers use to reduce sodium are monosodium glutamate (MSG), autolyzed yeast extracts, hydrolyzed vegetable protein, and soy

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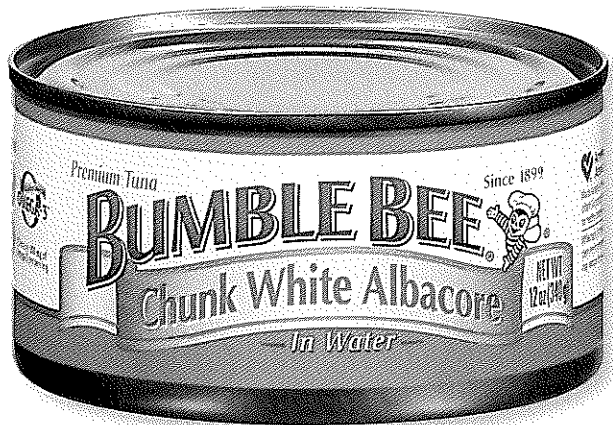
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Bumble Bee Foods has reduced the sodium of its line of albacore tuna products by 44%.

sauce. All of these enhancers contain glutamate, the amino acid responsible for the umami taste and intrinsic to meat, seafood, cheeses, and other protein-dense foods.

Derived from the fermentation of starch and beet sugar, cane sugar, or molasses, MSG is the taste enhancer used most widely throughout the food industry. Because of its high content of glutamic acid, MSG significantly intensifies the umami factor of foods. It comes in powder form, so it can be applied to just about any food to create a savory taste: gravy, soups, marinades, sauces, salad dressings, frozen entrées, and so on. However, MSG remains a controversial food additive despite having been recognized as safe by the U.S. Food and Drug Administration in 1959 and by the European Commission's Scientific Committee for Food in 1991 (Brandsma, 2006). Some consumers may exhibit intolerance to MSG known as MSG Symptom Complex; symptoms such as numbness, burning sensation, tingling, headache, nausea, and tachycardia may occur when MSG consumption exceeds 3 g per meal. Most processed foods containing MSG have less than 0.5 g. Food manufacturers concerned about consumer objections

to MSG use either autolyzed yeast extracts or hydrolyzed vegetable protein instead.

Autolyzed yeast extracts are the result of the breakdown of yeast cells through autolysis, releasing amino acids, salts, and carbohydrates. Considered all natural, autolyzed yeast extracts enable food processors to reduce sodium content and maintain a clean label simultaneously. The other commonly used MSG substitute, hydrolyzed vegetable protein, is the result of the chemical breakdown of grains (such as corn or wheat) or legumes (such as soy) into amino acids. Both yeast extracts and hydrolyzed vegetable protein are available as powders or pastes that vary from light-colored versions suitable for applications with a delicate to medium flavor, such as chicken or seafood broth, to dark versions for heartier, more robust applications such as beef gravy or beef stew. Innova's *Vegamine*[®] line of hydrolyzed vegetable proteins—one of only a few produced in North America—contains a wide assortment of flavor differentiations to ensure a custom flavor profile for a variety of savory applications. Whatever the color, strength, or flavor differentiation, hydrolyzed vegetable proteins and autolyzed yeast extracts can enhance the flavor of broths, soups, sauces, stews, processed meats, salad dressings, and even potassium chloride.

Soy sauce, a fermented sauce comprised of water, salt, and soybeans, enhances the umami, or savoriness, of various foods. Although soy sauce is fairly high in sodium, the overall sodium content of various dishes is reduced when replacing salt with soy sauce, according to a study (Kremer et al., 2009). Soy sauce has applications for salad dressings, meat marinades, soups, and sauces; it is not recommended for baked goods. The limited applications of soy sauce

somewhat restrict its usage in the food industry, but its usefulness includes elevating the sweetness of bitter foods and altering food color.

Regardless of the strategies food manufacturers use, reducing the amount of sodium in processed food is not a passing trend. Formulating recipes and developing food products with low sodium content is not going to be an option; it will likely become the standard. By incrementally trimming the sodium content of prepared foods over time in a coordinated effort, as the Institute of Medicine recommends, both food manufacturers and restaurants ensure that consumers will be less likely to notice as their taste perceptions adjust to the change. The popularity of various tactics for reducing sodium may rise or fall, but the objective of eliminating processed food as the main source of excessive amounts of sodium is a goal for which the reward is high: better nutrition and health for consumers worldwide. **FT**

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