Iodized salt does not cause sensory changes when used in processed foods

A comprehensive review confirms that the use of iodized salt in processed foods and condiments does not change the sensory properties of foods which could affect consumer acceptability or product quality.

Despite the global recommendation for fortification of all salt with iodine, including salt used in food processing, most salt iodization programs have focused only on household salt. However, the majority of sodium is consumed through processed foods and condiments rather than table salt, and the use of processed foods for iodine delivery has been credited with a reduction of iodine deficiency in many countries. In some countries, food manufacturers have expressed concern about the potential instability of iodine and changes in sensory properties of their products if iodized salt is used instead of non-iodized salt.

To allay these concerns, a comprehensive review was conducted of eligible studies examining the effect of salt iodized with either potassium iodide (KI) or potassium iodate (KIO3) on processed foods. A total of 34 studies on the effect of iodized salt on 38 types of processed foods were summarized.

Condiments
The effect of iodized salt has been studied in mayonnaise, fish sauce, soy sauce, margarine, and flavoring cubes (e.g., bouillon). Fish sauce made with iodized salt scored slightly better than with non-iodized salt for general appearance, color, flavor and overall acceptability. Color of fish sauce made with iodized salt was lighter than with non-iodized salt. Fermented fish made with iodized salt had similar or slightly higher acceptability scores to that made with non-iodized salt. Objective analysis found no differences in organoleptic characteristics of soy sauce made with iodized and non-iodized salt as analyzed by 10 experienced panelists and no differences in measured color or luster. Global use of flavoring cubes containing iodized salt has been reported since 1997, with no change to the sensory or technological characteristics of prepared foods. Retention of iodine in fish sauce and fermented fish was high (84–92% at the end of production), but was significantly lower in fish sauce made in sunlight (44% retention) compared to that made in the shade. Retention of iodine in soy sauce was 60% after production and 58% after 3 months of storage.

Cheese and dairy products
Iodized salt (KI and KIO3) was found to have no effect on the organoleptic properties or technological characteristics of hard and soft cheeses, dairy products, and cured ham/meat.

Bread
All salt used in bread making must be iodized in Australia, Austria, Denmark, Lithuania, New Zealand, and Romania. In some of these countries, bread made with iodized salt is the leading source of dietary iodine. The use of iodized salt in the production of staple foods such as bread has been demonstrated to add a significant quantity of iodine to the diet.

Organoleptic impacts of mandatory and voluntary use of iodized salt in commercial bread production have been studied in Australia, Belarus, Belgium, Bulgaria, Denmark, the Netherlands, New Zealand, and South Africa, where the concentration...
of iodine in iodized salt ranges from 13 to 85 ppm. Iodized salt had no effect on the sensory qualities of bread in these studies even when high levels of iodine were used. The retention of iodine in bread after production and storage was examined in 4 studies reporting 70–100% retention of iodine in white and whole grain bread and 38–46% retention in flat bread. There were minimal differences in retention between KI and KIO3 iodized salt.

Other starches
Food manufacturers frequently state concerns that iodized salt will lead to discoloration of starchy foods due to the use of starch in iodized salt testing kits where a color change is evident after interaction with iodized salt. However, no effects were found on the flavor or appearance of either potatoes or rice, and there were no color differences in products prepared with iodized salt (KI and KIO3) or non-iodized salt. The use of iodized salt (KI and KIO3) at concentrations more in line with levels in national salt iodization programs (40–77 ppm) had no effect on the color, taste or overall quality of French fries, boiled potatoes, or potato chips in two studies.

Processed meat products
There was no effect of iodized salt on the organoleptic properties of sausages, salami, hotdogs, or cured ham/meat regardless of the iodine compound used. However, the addition of KIO3 iodized salt affected the color, but not the taste, of mortadella, a high fat sausage, and another study reported an improvement in the color of cured meat made with KIO3 iodized salt.

Fish products
Two studies showed that KIO3 iodized salt had no effect on the organoleptic properties or physical characteristics of dried, salted, or smoked fish products, fermented shrimp, or anchovies. KI iodized salt had no effect on the stability of individual fatty acids in freshwater fish emulsion sausages after cooking and storage, and there was no lipid oxidation observed in the iodized product. There were no reported textural changes in the fish sausages.

Pickled vegetables
The addition of KI or KIO3 iodized salt at concentrations from 6 to 120 ppm caused no effect on the sensory properties or nutrition quality of pickled cucumbers, turnips, carrots, cauliflower, olives, sauerkraut, Sichuan pickles, potherb mustard, green tomatoes or sweet peppers, with the following exceptions:
• Pickled cucumbers, turnips, carrots, cauliflower and olives prepared with KIO3 iodized salt were darker and softer than pickles prepared with either KI iodized salt or non-iodized salt.
• Pickled cucumbers prepared with KIO3 iodized salt had a slightly different taste compared with non-iodized salt.
• Potherb mustard, a green leafy vegetable, was darker when prepared with iodized salt compared to non-iodized salt, however there was no difference in acceptability between products among consumers.

Canned foods
The use of iodized salt (KI and KIO3), even with iodine concentrations 30 times higher than levels in iodized salt, had no effect on organoleptic properties of canned foods such as tomato juice, green beans, olives and sweet corn after production or storage. While two studies found acceptable retention of both KI and KIO3 after processing and storage, one study found no retention of iodine in canned green beans prepared with KI or KIO3 iodized salt (40 ppm).

It was hypothesized that the high heat used in the canning process might be responsible for the loss.

Discussion
This review demonstrates that the use of iodized salt in the manufacturing of processed foods has no or minor effect on the sensory properties of a wide range of processed foods and therefore should not be a barrier to legislation, policy and practice of salt iodization.

The majority of countries in the world mandate the iodization of all edible salt, including salt in food processing. Although this component of the legislation is often not actively enforced, stakeholders and industry representatives report the use of iodized salt by a large number of food processors, producing a wide range of processed foods, sometimes unknowingly. At the same time, at least two countries—Brazil and the Philippines—include ‘exemption clauses’ in their legislation that will allow specific food producers or processed foods to be exempt if negative impacts are proven but no exemptions have been requested.

The use of iodized salt in processed foods has the advantage of flexibility, with iodine levels that can be adjusted to meet the dietary needs of a population. For example, the Netherlands monitors levels of iodine deficiency and adjusts the iodization level of bread salt to best address dietary requirement.

Conclusion
• Processed foods made with iodized salt are indistinguishable from those made with non-iodized salt. The use of iodized salt in processed foods is recommended as an excellent strategy to increase daily iodine nutrition without risk of affecting the organoleptic properties of foods. Governments can use this review to support policy decisions for iodized salt programs and legislation.
• Iodine status and the consumption of iodine from different sources, including iodized salt in processed foods, should be monitored in order to make necessary adjustments to iodization levels to ensure optimal iodine intake throughout the population.

References
A full list of references for this article is available (open access): https://link.springer.com/article/10.1007%2Fs13197-018-3277-9#Bib1