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Abstract

Meat curing is a food preservation technique that has been used for centuries, evolving from the simple addition of crude salt for control of spoilage to the sophisticated blends of salt, sugar, nitrite, flavorings, and other ingredients that are used for cured meats today. The hams, bacon, frankfurters, and other cured meats in supermarkets today provide consumers with the expected cured meat properties of color and flavor, properties that are consistent because of the curing process regardless of the specific manufacturer. How, then, can one explain the proliferation in the past 10 years of hams, bacon, frankfurters, and similar processed meat products that are labeled "uncured" but that still clearly demonstrate the typical properties of cured meat? This entry discusses the roles of nitrate and nitrite in meat curing, U.S. labeling regulations, and the issues associated with using the "uncured" label.

Keywords

meat curing, spoilage, stability

Disciplines

Agriculture | Animal Sciences | Meat Science

Comments

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economist who had lobbied for passage of the bill: For the story, Voltz also conducted an investigation of the foods in the local grocery store, looking for what was printed on the labels and then reporting the results. In the *Boston Globe*, Dorothy Crandall wrote about a new policy that would list vitamins and minerals on canned foods.

Celebrity-Syndicated Food Columns

Celebrity chefs and cookbook authors often had syndicated cooking columns in newspapers. James Beard wrote the column "Beard on Food." A collection of the columns was published in a book by the same name. Beard's newspaper columns were published in his book *Beard on Food*. The cookbook author Poppy Cannon penned the newspaper column "30-Minute Meals" that ran in many newspapers in the 1960s and 1970s. The cookbook author and newspaper food columnist Myra Waldo traveled the world to gather recipes, and they were syndicated under the This Week service; she wrote the column "How the World Cooks" in the 1960s. Julia Child wrote a food column for the *Boston Globe* in the 1960s and 1970s.

Food Columns in Post-Women's Pages Years

The women's pages and their food sections continued to be strong throughout the mid-century and into the 1970s. But as the 1970s wore on, the women's pages began to disappear from major newspapers. The sections were renamed—often Lifestyle or Style—and the content changed to become more entertainment oriented at most newspapers. Food sections, however, remained as stand-alone sections but were more often employing men. By 2013, several newspapers were reducing the content of the newspaper food sections, and columnists were more likely to be freelancers or from a nationally syndicated wire service.

Kimberly Voss

See also Food Writing in Books; Food Magazines; Food TV

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NITRATE, NITRITE, AND CURED VERSUS UNCURED MEATS

Meat curing is a food preservation technique that has been used for centuries, evolving from the simple addition of crude salt for control of spoilage to the sophisticated blends of salt, sugar, nitrite, flavorings, and other ingredients that are used for cured meats today. The hams, bacon, frankfurters, and other cured meats in supermarkets today provide consumers with the expected cured meat properties of color and flavor, properties that are consistent because of the curing process regardless of the specific manufacturer. How, then, can one explain the proliferation in the past 10 years of

hams, bacon, frankfurters, and similar processed meat products that are labeled "uncured" but that still clearly demonstrate the typical properties of cured meat? This entry discusses the roles of nitrate and nitrite in meat curing, U.S. labeling regulations, and the issues associated with using the "uncured" label.

Meat Curing

To understand this issue, it is, first of all, important to realize that the essence of cured meat is derived from nitrite, usually added to meat as sodium nitrite, which not only provides cured meat color, flavor, and flavor stability but also inhibits growth of most bacteria during distribution and storage. The role of nitrite in meat curing has been recognized since the very early 1900s when it was discovered that nitrate, which was used for meat curing at that time, had to be converted to nitrite by bacteria in order to achieve the expected cured meat color. As the meat industry evolved during the 20th century, addition of nitrite, rather than nitrate, to meat became the primary means of achieving the typical properties of cured meat.

An extensive amount of research in the past half-century has made it clear that nitrite is a very unique compound for meat curing and that no other single compound can substitute for nitrite to produce all the typical properties expected in cured meats. However, in the past 10 years, a new category of processed meat products that are typically cured have appeared in supermarkets. These products have all the properties of cured meats that result from nitrite but are labeled "uncured," even though it is clear that cured meat can only be produced by addition of nitrite. Even more confusing, chemical analysis of these "uncured" products will confirm the presence of nitrite and nitrate.

Why Some Cured Meats Are Labeled "Uncured"

To understand the apparent contradictory labeling of "cured" and "uncured" meat products, it is necessary to consider some of the historical issues that

have been associated with nitrite and meat curing, as well as the evolution of labeling regulations that were developed in response to the issues.

The first issue that developed was the result of the discovery in the late 1950s and early 1960s that nitrite could react with secondary amines in high-protein foods to form nitrosamines, which were subsequently shown to be potent carcinogens. This discovery resulted in intensive research and strong public debate over the next couple of decades about nitrite, cured meat, carcinogens, and human health. The public concerns over nitrite and the potential for carcinogens very nearly resulted in a regulatory ban on nitrite as a food ingredient. Had such a ban become a reality, there would be no ham, bacon, or other cured meats today as we know them because nitrite is irreplaceable as a meat-curing agent. Fortunately, research at that time also resulted in information that allowed the industry to make several changes in meat-curing procedures that significantly reduced the potential of nitrosamine formation and alleviated the associated human health concerns. However, despite the success of the changes implemented to virtually eliminate nitrosamines from cured meat, the intense public debate from that time period created a strong negative perception about nitrite by many consumers that still persists today.

One of the results of the public debate and consumer perceptions of nitrite in the 1970s was a call by some consumers for ham, bacon, and similar meat products without nitrite. The consumer interest in "nitrite-free" processed meats resulted in industry development, at that time, of a few truly uncured meat products that were attempts to provide a nitrite-free substitute for traditionally cured products. However, these products did not look or taste the same as traditionally cured products, nor did they provide similar shelf life and safety assurance as the traditionally cured products. Consequently, the U.S. Department of Agriculture (USDA) in 1972 established the requirement that these products "for which there is a standard and to which nitrate or nitrite is permitted or required to be added, may be prepared without nitrate or nitrite and labeled with such standard name when

immediately preceded with the term "Uncured" (Products and Nitrates and Nitrites, 1979, p. 297). This regulation was amended in 1979 to include the statement "No Nitrate or Nitrite Added" adjacent to the product name. These regulations made good sense when implemented because standardized cured meats such as hams, bacon, and frankfurters are much different if nitrite is not added, and the labels were intended to communicate the differences (i.e., "uncured") to consumers. These regulations are still in effect and are the first piece of the contradictory labeling puzzle that has developed since that time.

The second USDA labeling requirement that has contributed to the current labeling issue for "uncured" products is the definition developed in the 1980s for products to be labeled "natural." Processed meat products labeled "natural" cannot include any ingredients classified as "chemical preservatives." Because nitrite is considered a chemical preservative, it cannot be added to any processed meat that would be labeled "natural."

The third labeling requirement that became part of the puzzle resulted from the 1990 Organic Foods Production Act, which established a list of allowed and prohibited ingredients in foods labeled as "organic." Nitrate and nitrite are two of the ingredients that are not allowed in organic products.

The cumulative effect of these past regulations is that any processed meat product that is labeled natural or organic cannot include nitrate or nitrite as an added ingredient. Furthermore, if a natural or organic processed meat product is manufactured to simulate a traditionally cured product that is a standard product (e.g., ham, bacon, and frankfurters), then the product must be labeled "uncured" because nitrate or nitrite has not been added. Until about 2001, very few of these products could be found in supermarkets because they did not have typical cured meat color and appearance. However, the rapid growth of consumer demand for natural and organic foods provided considerable motivation for meat processors to provide consumers with natural and organic processed meats. Because of the well-established consumer demand for the

traditional cured meats, it was also clear that if natural and organic processed products could be manufactured with typical cured meat properties, these products would be very appealing to consumers. As the markets for natural and organic foods continued to grow very rapidly in the mid- to late 1990s, ideas about how to manufacture natural and organic processed meats with typical cured meat properties began to emerge.

Development of a "Natural Curing" Process

It has been known for many years that some vegetables, particularly celery, spinach, and Swiss chard, contain significant amounts of nitrate. It has also been well established that certain bacteria contain reducing enzymes that will convert nitrate to nitrite. Thus, in the late 1990s, these ideas began to come together. The initial concept for a "natural" curing process consisted of a vegetable juice concentrate (most often celery) added to meat as an ingredient with a nitrate-reducing bacterial starter culture. This combination will produce nitrite, which then will react with the meat in the same fashion and with the same results as if nitrite were added as an ingredient. However, because the vegetable concentrate and starter culture are natural products and can be certified as organic, processed meats manufactured with this approach qualify for labeling as natural or as organic. At the same time, because nitrite is not added as an ingredient, the 1972 USDA regulation applies, and the product must be labeled "uncured" to comply with that regulation.

Once this concept was demonstrated as effective for producing products with typical cured meat properties, the technology was quickly adopted by several meat processors, and a wide variety of naturally cured products labeled "uncured" began proliferating in the supermarkets. It did not take long for suppliers of the vegetable concentrates to realize that they could shorten the time required for the process, and make the use of the vegetable concentrate much more convenient, by converting the nitrate to nitrite before providing it to meat

processors. This now has become the standard procedure for most of the natural and organic "uncured" meat products that utilize a standard cured meat product name.

The development of the "natural curing" process has resulted in a group of products that are labeled "uncured" but that have all the typical properties of cured meats. Furthermore, chemical analysis will show that these products contain a small but measurable amount of nitrate and nitrite.

Issues Associated With "Naturally Cured" Meat Products

The most obvious issue currently associated with the naturally cured products that are labeled "uncured" is that the label is not truthful. While the labeling of these products is the result of a combination of past regulations as described earlier, and is required by the USDA, it does not accurately communicate to consumers that the products have been cured using an alternative process that allows the products to qualify as natural or organic. This conundrum is recognized by both the meat industry and the USDA, and several suggestions for change have been made. However, it has been difficult to find a suitable alternative labeling option that is both accurate and that meets the regulations currently in place. While "naturally cured" would seem to be a suitable alternative, it does not meet the current regulatory definition of curing, which is the direct addition of nitrate or nitrite to meat as an ingredient. Furthermore, the USDA does not currently have a definition for "natural curing" or "naturally cured," so these terms cannot be used on product labels at the present time. It should be noted that meat industry representatives and USDA personnel have been discussing this labeling issue, and some new labeling alternatives may be offered in the future.

The second issue associated with "naturally cured" meats arises from the well-known preservative role that nitrite plays in cured meat products. Nitrite is a very effective antimicrobial agent, so much so that reducing nitrite concentrations with all else equal in processed meats generally results in

faster bacterial growth, including both spoilage bacteria and potential pathogenic bacteria. Research has demonstrated that the "naturally cured" meats typically have less nitrite than traditionally cured products because the amount of vegetable concentrate that can be added is limited by a "vegetable-like" flavor that becomes detectable as concentration increases. Most meat processors are using the vegetable concentrates at 0.3% to 0.4% of the meat product formulation. These concentrations have been shown to result in very typical cured meat color, flavor, and all cured meat properties but with a reduced antimicrobial impact. However, it is important to note, over the past 10 years that the "naturally cured" processed meats have been available, there have been no documented cases of foodborne illnesses originating from these products. It appears that good manufacturing practices, sanitation, packaging, and temperature control have maintained the safety of the natural and organic processed meats. At the same time, because the margin of safety is reduced when nitrite concentration is reduced, meat processors have been evaluating several options to add an extra margin of safety to the naturally cured processed meat products.

Increasing the Safety Margin for "Naturally Cured" Meats

There are several options available to meat processors to compensate for the reduced nitrite concentration and reduced antimicrobial protection in naturally cured meat products. Some of these are ingredients that will be obvious in the product ingredient list, but others are processing treatments that will not be included on the product label. One of the simplest processes is a heat treatment of the finished, packaged product. By reheating a product after packaging, bacteria on the product surface can be killed, and because surface contamination is the biggest issue for a cooked, ready-to-eat product, postpackaging heat application can significantly improve both shelf life and safety.

Another process that is currently used by a number of processors is high-pressure processing. This process uses very high hydrostatic pressure

for treatment of packaged products. The process destroys bacteria without any significant product changes and has become the method of choice for some major meat processors.

Several ingredients have shown potential as supplemental antimicrobial agents. However, to be used in natural or organic products, these ingredients must qualify as natural or organic and cannot be classified by the USDA as preservatives. This has limited many of the ingredients known to be effective antimicrobial agents and has focused attention on natural products with antimicrobial properties. A variety of plant and spice extracts, and other similar products, are being researched and may become available as commercial products in the future, if proven successful.

The Bottom Line

Nitrate and nitrite are irreplaceable curing compounds that are essential to the manufacture of any truly cured meat product. However, a sequence of unrelated government regulations between 1972 and 1990 has resulted in a group of processed meat products with unusual, confusing, and technically incorrect labels. These are products cured with natural ingredients such as celery powder, which contains high concentrations of nitrate and/or nitrite. Regulations define any such product that does not have nitrate or nitrite directly added as "uncured" and requires this notation on the label. While the lesser amount of nitrite typically found in these products may be an issue in terms of implications for food safety, no observed foodborne outbreaks from these products have occurred. The major issue with these products remains the incorrect and confusing "uncured" labeling required at the present time.

Joseph G. Sebranek

See also Food Additives; Meat Processing; Organic Foods and Health Implications

Further Readings

Interpretation and statement of labeling policy for cured products; special labeling requirements concerning

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NOISE IN RESTAURANTS

Sound and noise provide a set of aesthetic and commercial cues for restaurateurs. Whether it is considered sound or noise depends on the listener as well as the desired atmosphere. In this manner, although often overlooked, noise is an important design element for restaurants.

This entry focuses on sound and noise in restaurants. People often refer to more chaotic and obtrusive sounds, particularly loud ones that disturb people or make it difficult to hear wanted sounds, as noise. This is in some ways, of course, an issue of individual interpretation; context and preference create the distinction between sound and noise. A sound that annoys one person, and thus becomes noise, may not annoy another. Restaurant patrons are often plagued by noise, consistently citing it as one of their top complaints. Sound in restaurants comes from a variety of sources, including the variety of hard surfaces, the conversations and cell phones of patrons, and the