

# Understanding Processed Meat

Kathleen Zelman, MPH, RDN

Consumers today want to eat healthy but are so confused about the idea of ‘clean eating’ as many seek to avoid preservatives, additives and scary sounding chemicals added to their food. Processing is one of those terms that has led to much misunderstanding, especially surrounding processed meats.

Today we explore meat processing, related health concerns and how registered dietitians can address the subject to help consumers and clients understand how to make healthy choices at the meat counter.

## What is Processing?

All meat and poultry is processed, as is most food that we eat today. The term is used to define the act of physically changing, altering or transforming a product.

Some plant foods can be enjoyed straight from the tree, bush or ground but grains, dairy, legumes, nuts, meats and some fruits and vegetables undergo some form of processing to make them edible. Think of processing as a spectrum from the simplest process of making orange juice from fresh oranges to the making of a highly processed artificial food like whipped topping.

All meat must be processed to be edible. Minimally processed meat is the correct term for raw, uncooked meat products that have been minimally altered (grinding, cutting) to create familiar cuts like strip steaks. No additives or preservatives are used in minimally processed meats, it is simply processed from the whole animal into edible portions you see in the grocery store. This includes raw, uncooked meat products that have not been significantly altered, but have been reduced in size through fabrication, mincing or grinding.

Further processed is the term used for meat and poultry that has been transformed through salting, curing, fermentation, smoking, cooking, batter/breading and/or the addition of ingredients to enhance flavor or improve preservation. These products may include ready-to-cook and ready-to-eat products. Examples include hot dogs, ham, sausages, corned beef, lunch meat, bacon or beef jerky as well as canned meat and meat-based preparations.

## Ingredients Used in Processing

Ingredients typically used in processing include sweeteners, salt, sodium nitrite, spices, antimicrobials (food safety) and preservatives.

Added ingredients are chosen for very specific purposes. Fresh sausages, for example, add antimicrobials to prevent spoilage bacteria and hot dogs need preservatives like binders to keep meat intact.

Sodium nitrite and nitrate have been curing and providing protection from spoilage and extending shelf life in meat since ancient times.

“Nitrites are absolutely essential for the safety of processed meat. Without nitrites, dioxins in meat would post major health concerns,” says Baylor College of Medicine assistant professor, Nathan Bryan, Ph.D.

Sodium nitrite, sodium ascorbate or sodium erythroate are frequently used preservatives that control and prevent *Listeria*, botulism and other pathogens. Preservatives such as these increase shelf life of further processed meat 10-15 fold, prevent rancidity by controlling fat oxidation and also creates a unique flavor profile.<sup>1</sup>

Nitrate and nitrite (short for sodium nitrite and sodium nitrate) are classified as curing ingredients because they trigger biological reactions when added to meat. They serve a dual purpose as they are also classified as preservatives because of their ability to slow almost all food spoilage bacteria.

“There have been no cases of botulism in the United States in processed meats because these preservatives are so effective at controlling pathogens, extending shelf life, resisting oxygenation and creating the new pink pigment which is much more stable than the red pigment in muscle meat,” says Jeff J. Sindelar, Ph.D., Extension Meat Specialist, University of Wisconsin-Madison.

Sodium compounds play a critical role in further processed meats.

“Without salt, some processed meats couldn’t be made. It is important for extracting meat proteins and binding them together to give meats like ham its firm texture and in hot dogs keeps the meat bound” says Sindelar. Binders and extenders work with salt to help the meat hold water and prevent the product from changing after it is cooked.

Taste is secondary to functionality when it comes to salt as very little salt is needed to impact taste threshold.

There have been a variety of nutrition formulations in the marketplace to give consumers choices. Some meat processing uses celery salt instead of sodium nitrite, as celery salt is a natural form of nitrite, which serves an identical function. For the past 20 years the food industry

has been trying to replace sodium nitrate without success due to its unique functionality.

### **Understanding Nitrites and Nitrates:**

Sodium nitrate is a naturally occurring chemical compound found in soil, water, plants and our own bodies. In the presence of bacteria, nitrate is converted to nitrite. Bacteria in the mouth naturally convert nitrate into nitrite. When used in processed meats, nitrate is typically converted to nitrite by the addition of a starter culture, but this can also occur naturally in some cases. Nitrites are further reduced to nitric oxide along the oxygen gradient.

Despite concerns over these compounds, a body of evidence has shown indisputable health benefits of nitrite and nitrate derived from food sources or in clinical settings.<sup>2,3</sup> Most of the studies show nitric oxide as the mechanism of action for nitrite and nitrate. "At certain thresholds, they have been shown to have beneficial effects to lower blood pressure, improve cardiovascular diseases and preventing cancers", says nitric oxide expert, Bryan.<sup>4,5</sup>

Breast milk, one of Mother Nature's most perfect foods, has the highest concentration of nitrite. The presence of nitrate and nitrite in breast milk has been shown to offer gastrointestinal microbiota protection in the infant.<sup>6</sup>

Nitrites are essential and our bodies make about 20 mg of nitrite and 300 mg nitrate. You can also get it through dark leafy greens, supplements or other dietary foods. "Approximately 80-85 percent of nitrites/nitrates come from green leafy vegetables, 15 percent from swallowing your own saliva and only 5-6 percent from cured meats" says Bryan. Celery, leafy greens, beets, parsley, leeks, endive, cabbage and fennel are the most potent vegetable sources.<sup>7</sup>

To expand the knowledge and role of nitrites, there are currently a number of clinical trials investigating the use of sodium nitrite as a therapeutic agent in health conditions.

### **FDA and USDA Oversight**

Most consumers are unaware of the strict standards required by the Food and Drug Administration (FDA) for the use of food additives and the role these additives play in keeping our food supply vast and safe.<sup>8</sup>

FDA provides strict oversight and usage requirements on all additives to meet consumer expectations and for food safety. Both nitrate and nitrite are approved for use in foods by FDA and United States Department of Agriculture (USDA) in carefully controlled amounts and are specified when nitrate/nitrite is required, allowed or prohibited.

Many meat products are now making 'nitrate and nitrite free' claims to ease consumer fears. When celery salt is used as a sodium nitrite substitute it must be labelled as 'uncured'. However, when analyzed, these products look the same as conventionally cured meats because of the celery salt's high nitrate content.

Muscle meat products do not allow any added artificial coloring, flavoring or preservatives. Organic meat products must follow the standards of the National Organic Program and are not allowed to use sodium nitrite.

All added ingredients must appear on the label on the list of ingredients.

### **Nitrosamines and Health Risks**

Nitrates and nitrites were originally linked to cancer because researchers discovered back in the 1970s that meats containing sodium nitrite when cooked at high temperatures could create nitrosamines, compounds that are carcinogenic to animals. Nitrosamine formation is the largest concern in bacon and according to USDA, nitrosamines can be found when bacon is fried at 350 °F for 6 minutes (medium well), 400 °F for 4 minutes (medium well), or 400 °F for 10 minutes (burned).

Nitrosamine concerns triggered a debate on the safety of nitrates and nitrites and cast a dark shadow over cured meats. Subsequently, USDA placed limits on the amount of nitrites added to cured meat and required the addition of vitamin C in bacon to prevent the formation of nitrosamines. Vitamin C is often added to other cured products as well.

Some epidemiologic studies have linked consumption of processed meat with obesity, type 2 diabetes, cardiovascular diseases and cancers.<sup>9</sup> High intakes of processed meat have been associated with colorectal cancer<sup>10</sup> in some studies, but not in others.<sup>11, 12</sup>

In 2000, the U.S. National Toxicology Program completed a multi-year bioassay in which laboratory animals were fed nitrate and nitrite in their drinking water. After reviewing the study's evidence, a panel of scientists found that nitrate and nitrite did not pose a risk of cancer at the levels used.<sup>13</sup>

A 2015 International Agency for Research on Cancer (IARC) review of the science sent shock waves through the media when it linked processed meats with cancer.<sup>14</sup> Yet, according to the World Health Organization website, 'consumption of processed meat was associated with small increases in the risk of cancer in the studies reviewed.' Further, in a press release, Dr Kurt Straif, Head of the IARC Monographs Program said, "For an individual, the risk of developing colorectal cancer because of their consumption of processed meat remains small, but this risk increases with the amount of meat consumed."

Understanding the actual risk has bred much confusion. Epidemiological studies provide associations that are certainly worth further study, but a correlation is not the same as causation, and relative risks are not the same as absolute risks.

"The information collected and the methodology were highly flawed, they did not take into account the understandings of meat and processed meat" says Sindelar of the IARC review. What's more, only seven studies qualified for the review, not 800, as noted in the paper.

“There is no scientific basis that nitrite/nitrate causes cancer and is equivalent to cigarette smoking” says Bryan, co-editor of *Nitrite and Nitrate in Human Health and Disease*.

Separately from nitrosamine, some have raised concerns about heterocyclic amines (HCAs) and polycyclic aromatic hydrocarbons (PAHs) which can form when fresh and processed meat and poultry are cooked at high temperatures. The American Cancer Society, for instance, recommends limiting processed meat consumption and preparing meat and poultry by broiling, baking and poaching instead of frying and charbroiling.<sup>15</sup> However, research has shown that marinating meat and poultry or simply using spices like black pepper, oregano or garlic can nearly eliminate formation of these compounds. (16) USDA writes “eating moderate amounts of grilled meats like fish, meat, and poultry cooked – without charring or burning – to a safe temperature does not pose a problem.”<sup>17</sup>

Strong evidence from primarily epidemiological studies shows that ‘lower intake of meats as well as processed meats and processed poultry are associated with reduced risk of CVD in adults’ says the Dietary Guidelines. Only moderate evidence are associated with risk reduction for obesity, type 2 diabetes and some cancers in adults.<sup>18</sup>

### How Much is Too Much?

According to USDA, meat, poultry and fish contribute just 17 percent of calories to the typical American diet. The 2015 Dietary Guidelines (DG) recommends a variety of dietary patterns that are rich in plant foods and also ones, such as the Mediterranean and DASH diets, that contain dairy, meat and eggs.

Notably, the 2015 Dietary Guidelines Advisory Committee also examined various dietary patterns and found that followers of the highly-regarded Mediterranean diet on average eat twice as much processed meat as followers of the typical USDA pattern.<sup>19</sup>

Clearly, a diet containing excessive processed meats is not healthy nor is it recommended – just as any imbalanced diet is not recommended. Nevertheless, processed meat can fit into a healthy dietary pattern when consumed in moderation within the context of a healthy dietary pattern. How much is too much? It is hard to say. There is no simple answer. When processed meats replace fruits, vegetables, whole grains, and other nutritious plant foods, it is cause for concern. Because processed meats can be a source of added sodium and saturated fats, the DG recommends choosing lean cuts with lower sodium to control fats, sodium and calories within limits of individualized eating patterns is recommended by the 2015 Dietary Guidelines for Americans.<sup>18</sup>

*‘For those who eat animal products, the recommendation for the protein foods subgroup of meats, poultry, and eggs can be met by consuming a variety of lean meats, lean poultry, and eggs. Choices within these eating patterns may include processed meats and processed poultry as long as the resulting eating pattern is within limits for sodium, calories from saturated fats and added sugars, and total calories.’*

### Bottom Line: Eat Healthy

All foods in moderation can fit within the context of a healthy diet and lifestyle, including further processed meats. “As a part of a healthy balanced diet, processed meats of any kind are completely safe” says Sindelar.

To help clients and consumers navigate the wealth of food choices, it’s important to put it all into perspective. There are many options toward the goal of eating healthy and optimizing health. Choose foods that you enjoy within the overall context of a healthy dietary pattern.

“As RDs we need to foster understanding that nutrition is individualized and multiple factors impact health including dietary patterns, exercise, lifestyle, genetics, smoking, alcohol and more’ says Kerri B. Gehring RD, Ph.D., Texas A&M meat science professor.

#### Resources:

1. Sindelar, J. et al. Human safety controversies surrounding nitrate and nitrite in the diet. *Nitric Oxide* 26 (2012) 259–266.
2. Bryan NS, Ivy JL. Inorganic nitrite and nitrate: evidence to support consideration as dietary nutrients. *Nutr Res* (2015), Volume 35, Issue 8, Pages 643-654.
3. Bedale, W et al. Dietary nitrate and nitrite: Benefits, risks, and evolving perceptions. *Meat Science* 120 (2016) 85–92.
4. Parthasarathy, D and Bryan, N. Sodium nitrite: The “cure” for nitric oxide insufficiency. *Meat Science* 92 (2012) 274–279.
5. Bryan, N. et al. Oral Microbiome and Nitric Oxide: the Missing Link in the Management of Blood Pressure. *Curr Hypertens Rep* (2017) 19:1-8.
6. Hord NG, Ghannam JS, Garg HK, Berens PD, Bryan NS. Nitrate and Nitrite Content of Human, Formula, Bovine, and Soy Milks: Implications for Dietary Nitrite and Nitrate Recommendations. *Breastfeeding Medicine*. 2011;6(6):393-399.
7. Nunez de Gonz, A. et al. A Survey of Nitrate and Nitrite Concentrations in Conventional and Organic-Labeled Raw Vegetables at Retail. *Journal of Food Science*; vol. 80; number 5, 2015.
8. FDA website: <http://www.fda.gov/Food/GuidanceRegulation/GuidanceDocumentsRegulatoryInformation/LabelingNutrition/ucm064880.htm#common>
9. Boada, L. et al. The impact of red and processed meat consumption on cancer and other health outcomes: Epidemiological evidences. *Food Chem Toxicol*. 2016 Jun;92:236-44.
10. Alexander, D.D. et al. Processed meat and colorectal cancer: a quantitative review of prospective epidemiologic studies, *European Journal of Cancer Prevention* 2010, 00:000–000.
11. Cho, E and Smith-Warner, S., Meat and fat intake and colorectal cancer risk: A pooled analysis of 14 prospective studies, *Proc Amer Assoc Cancer Res*, Volume 45, 2004
12. National Toxicology Program Technical Report on the Toxicology and Carcinogenesis Studies of Sodium Nitrite, (CAS NO. 7632-00-0) in 344/N Rats and B6C3F1 Mice (Drinking Water Studies) <https://health.gov/dietaryguidelines/2015-BINDER/meeting6/docs/DGAC-Meeting-6-SC-1.pdf>
13. IARC Monographs evaluate consumption of red meat and processed meat, World Health Organization, October 26, 2015, accessed at [https://www.iarc.fr/en/media-centre/pr/2015/pdfs/pr240\\_E.pdf](https://www.iarc.fr/en/media-centre/pr/2015/pdfs/pr240_E.pdf), October 15, 2017
14. Bouvard, Véronique et al. Carcinogenicity of consumption of red and processed meat. *The Lancet Oncology* , Volume 16 , Issue 16 , 1599 – 1600.
15. American cancer society: <https://www.cancer.org/healthy/eat-healthy-get-active/acs-guidelines-nutrition-physical-activity-cancer-prevention/summary.html>
16. Smith, JS. et al. Effect of marinades on the formation of heterocyclic amines in grilled beef steaks, *Journal of Food Science*; vol 73; number 6, 2008
17. USDA website: [https://askkaren.custhelp.com/app/answers/detail/a\\_id/1058/~what-are-heterocyclic-aromatic-aminas%3F](https://askkaren.custhelp.com/app/answers/detail/a_id/1058/~what-are-heterocyclic-aromatic-aminas%3F)
18. U.S. Department of Health and Human Services and U.S. Department of Agriculture. 2015 – 2020 Dietary Guidelines for Americans. 8th Edition. December 2015.
19. U.S. Dietary Guidelines Advisory Committee Meeting, 2015 Dietary Guidelines Advisory Committee Meeting 6, Slide 21 and 35, <https://health.gov/dietaryguidelines/2015-BINDER/meeting6/docs/DGAC-Meeting-6-SC-1.pdf>