

In the minds of today's consumers, "processing" is a negative term and should be avoided. Consumers want to eat healthfully but are so confused, especially when it comes to understanding terminology found on food labels.

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

What is Processing?

All meat and poultry are processed, as is most food that we eat today. Processing is simply the term used to define the act of physically changing, altering or transforming any food or beverage.

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. Imagine processing as a broad spectrum from the simplest process of making orange juice from fresh oranges to the highly processed manufacturing of a plant-based meat alternative processed to look, taste and bleed like real meat.

All meat must be prepared to be edible and to improve the digestible and nutritive value. 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 or pork chops. No additives or preservatives are used. It is simply processed from the whole animal into edible portions you see in the grocery store. It includes raw meat products that have been negligibly altered such as through 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 and safety. 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 spices such as garlic, paprika and pepper; preservatives such as salt and sodium nitrite; and antimicrobials for food safety.

Each added ingredient is carefully chosen for a very specific purpose. Fresh sausages, for example, often have a small amount of salt added to provide a desirable texture and for flavor while antimicrobials are commonly added to hot dogs and other cooked sausages to prevent dangerous bacteria spoilage and to improve shelf life.

Sodium nitrite and sodium nitrate have been used for curing, controlling dangerous bacteria, retaining the red color and extending shelf life (by slowing quality deterioration) since ancient times. "Nitrites are absolutely essential for the safety of processed meat. Without nitrites, bacterial dioxins in meat would pose major health concerns," says Baylor College of Medicine assistant professor, Nathan Bryan, PhD.

Sodium nitrite and sodium ascorbate or sodium erythrodate are frequently used preservatives that control and prevent *Listeria monocytogenes*, *Clostridium botulinum* and other pathogens. Preservatives such as these also increase shelf life of further processed meat 10-15 fold, prevent rancidity by controlling fat oxidation and create a unique flavor profile.⁽¹⁾

Nitrate and nitrite (short for sodium nitrite and sodium nitrate) are classified as curing ingredients because they trigger biological reactions when added to meat and are also classified as a preservative.

"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, PhD, 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 adding sodium compounds as very little salt is needed to impact the taste threshold. The North American Meat Institute has catalogued a variety of nutrition formulations in the marketplace to give consumers choices (<http://www.meatpoultrynutrition.org/productcenter>). Some meat processing reduces sodium nitrite by using celery salt, juice or powder, all of which have a very high concentration of natural nitrate that when added with a bacterial culture, reduces nitrite.

Creating products for every taste preference and nutrition need

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Understanding Nitrite and Nitrate:

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. Nitrite is the active species. Bacteria in the mouth naturally convert nitrate into nitrite. In processed meats, nitrate is converted to nitrite by the addition of a starter culture. Nitrite is further reduced to nitric oxide along the oxygen gradient. Despite concerns over these compounds, a body of evidence has shown health benefits of nitrite and nitrate derived from food sources and in clinical settings. (2, 3) 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 prevent cancers” says nitric oxide expert, Bryan. (4, 5)

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. (6)

Nitrite is essential and our bodies make about 20 mg of nitrite and 300 mg nitrate. You can also get it through dark leafy greens, celery, beets, parsley, leeks, endive, cabbage, fennel, cured meats and supplements. (7) “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.

Sodium nitrite is being studied extensively for its promising role in health. Typically, sodium nitrite solutions have shown benefit in skin ulcers from sickle cell disease (8). Dietary nitrate could be an inexpensive alternative effective at reducing blood pressure and thus improving heart health (9). Oral sodium nitrite is a hopeful therapy for at-risk obese adults with metabolic syndrome to improve insulin sensitivity, blood pressure and arterial thickening (10). Inhaled nitrite may offer a potential therapy for heart failure (39). Numerous clinical trials are investigating the use of sodium nitrite in cardiac arrest, hypertension, arterial health and more.

FDA and USDA Oversight

Most consumers are unaware of the stringent 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. (11)

FDA provides strict oversight and usage requirements on all additives to meet food safety standards and consumer expectations. Since 1925, both nitrate and nitrite have been approved for use in foods by FDA and United States Department of Agriculture (USDA) in carefully controlled amounts and specifically when nitrate/nitrite is required, allowed or prohibited. In general, once FDA approves the safety of additives, it is the responsibility of the USDA to determine safe amounts used in meat products.

Many meat products are now making ‘nitrate and nitrite free’ claims to ease consumer fears. When celery powder is used to replace most of the sodium nitrite, it is labelled as ‘uncured’ with a few exceptions. When analyzed, these products look the same as conventionally cured meats because of celery’s naturally high nitrate/nitrite content.

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 food label on the list of ingredients.

Nitrosamines and Health Risks

Nitrate and nitrite were originally linked to cancer when 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 concerns triggered a debate on the safety of nitrate and nitrite and cast a shadow over cured meats.

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).

Subsequently, USDA placed limits on the amount of nitrite added to cured meat and required the addition of sodium erythorbate or sodium ascorbate (form of vitamin C) in bacon to prevent the formation of nitrosamines. Nitrite added directly to prepared meat along with changes in manufacturing have resulted in better control of the dose and concentration and solved the issue of nitrosamine formation in cured meats. (12)

Scientific Review

Epidemiologic studies have raised concerns over the association of excess prepared meat consumption and risks for type 2 diabetes, cardiovascular diseases, some cancers and mortality. (13, 14,15)

High intakes of processed meat have been associated with colorectal cancer in some studies, but not in others. (16, 17, 18) 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. “There is no scientific basis that nitrite/nitrate causes cancer and in fact, may even protect from cancer” says Bryan, co-editor of Nitrite and Nitrate in Human Health and Disease.

The most recent controversy around red and prepared meat centers on a series of systemic reviews and one guideline published in the November 2019 Annals of Internal Medicine. (20-26). The studies were conducted by NutriRECS, an international coalition of scientists, who challenged the current limitations on red and prepared meat concluding the evidence is weak. They recommended that adults continue their current consumption which is within the recommendations of the Dietary Guidelines for Americans. (25)

The International Agency for Research on Cancer (IARC) report associated meat, especially processed meat, and cancer risk (19, 27) 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.’ What’s more, in a 2015 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.”

“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.

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 (36). 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 (37). 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.” (38)

Understanding 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. It is important to understand this classification is based on hazard, the potential source of adverse health effect, not risk, the likelihood it will cause harm. Both tobacco and processed meats were declared a class one carcinogen yet they don’t have the same level or risk as long as you enjoy prepared meats in moderation.

Still, the American Cancer Society guidelines for nutrition and physical activity recommends minimizing intake of processed meats such as bacon, sausage, lunch meats and hot dogs. (28)

How Much is Too Much?

According to USDA, meat, poultry and fish contribute just 17 percent of calories to the typical American diet. (29) Despite concerns over processed meat intake, there has not been a change in the amount consumed by U.S. adults in the last 18 years, roughly 187g/week. (30)

The 2015 Dietary Guidelines 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. (31)

Notably, the 2015 Dietary Guidelines 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. (32)

Both the American Heart Association and the American College of Cardiology recommend a healthy diet as ‘comprised of high quantities of non-starchy vegetables, fruits, whole grains and legumes plus moderate consumption of nuts, seafood, lean meats, low-fat dairy and vegetable oil.’ (33). They warn, intake of processed meats, such as deli/cold cuts, sausage and bacon should be minimized because they have the greatest association with adverse health outcomes, however there are several products that fit within AHA recommended guidelines for consumers to choose from that are catalogued by the North American Meat Institute. www.meatpoultrynutrition.org (34)

How much is too much? It is hard to say. There is no simple answer. When prepared meats replace fruits, vegetables, whole grains, and other nutritious plant foods, it is cause for concern. Because prepared meats can be a source of added sodium and saturated fats, the DGA recommends choosing lean cuts with lower sodium to control fats, sodium and calories within limits of individualized eating patterns. This is recommended by the 2015 Dietary Guidelines for Americans (31):

‘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 a Healthy Balanced Diet

Clearly, eating prepared meat is a hot topic of debate. Excessive consumption is not healthy nor is it recommended.

All foods in moderation can fit within the context of a healthy diet and lifestyle, including prepared 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, PhD, Texas A&M meat science professor.

SOURCES:

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CLINICAL TRIALS:

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(<https://clinicaltrials.gov/ct2/show/NCT02527837>) sodium nitrite and arterial health

<https://clinicaltrials.gov/ct2/show/NCT00103025>

<http://grantome.com/grant/NIH/R01-HL129722-01A1-cardia-arrest>

<https://www.mayo.edu/research/clinical-trials/cls-20144039>



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