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Popular Article

## Effect of Natural Ingredients on Meat and Meat Products

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### Introduction

The consumption of natural ingredients is an age-old practice. Our ancestors were aware of the health promoting effects of natural food ingredients since time immemorial. Natural food ingredients are known for their beneficial health effects since antiquity. Valorization of natural ingredients for their inherent potentials like antioxidant, antimicrobial, anti-inflammatory, health-promoting activities etc. will make them healthier alternatives to chemical substances in meat and meat products in the years to come. Meat and meat products, due to their perishable nature are very much susceptible to oxidation and quality deterioration (Das et al., 2020). Lipid and protein oxidation of meat during processing and storage is one of the major issues responsible for exerting negative impacts on meat quality and human health. Meat is very much prone to microbial spoilage because of its nutritional compositions like amino acids, water-soluble proteins, fatty acids, almost natural pH, and high-water content, which make it an ideal medium for microbial growth. (Papadochristopoulos et al., 2021). For all the reasons, in order to maintain the consumer's health, quality of the products and extend the shelf-life meat and meat products, different natural preservatives are added during processing and packaging.

Natural food ingredients are widely derived from plant or plant parts, animals and other beneficial microbes etc (Papadochristopoulos et al., 2021). The different natural ingredients used to extend safety and shelf life of meat and meat products are better known as the “bio-preservatives” and possess good antioxidant and antimicrobial activities.

### Objectives

1. Extending Safety and Self Life of Meat and Meat Products.
2. To prevent or delay undesirable changes to the appearance, flavor, odor, and texture.

## Natural Preservatives

- a. From Plant origin e.g.- Plant extracts, Essential oils etc.
- b. From Animal origin e.g.- Chitosan, Bioactive peptides.
- c. From Microbial origin e.g.- Bacteriocins, Organic acids etc

## Common natural preservatives and their active compounds

The natural preservatives used for improving meat quality and extending the shelf life of meat and meat products are mostly different plant extracts and essential oils. Major antimicrobial and antioxidant compounds obtained from plants are phenolic compounds, terpenes, aldehydes, ketones, aliphatic alcohols, isoflavonoids etc (Papadochristopoulos et al., 2021).

### a. From Plant origin e.g.- Plant extracts, Essential oils etc.

**a) Rosemary**-Rosemary possesses antioxidant and anti-microbial properties and is high in phenolic acids and flavonoids, it has long been utilized as a preservative in the meat food sector. Active compounds of rosemary essential oil interact with bacterial membrane and its proteins, as a result disintegration and dysfunction of the membrane occurs. In addition to this, the alteration in genetic characteristics and fatty acid composition of the cell membrane, changes in nutrient content and leakage of cellular contents have been observed in microbes.

**b) Thyme and Oregano**-Thyme and Oregano contain bioactive compounds thymol and carvacrol, respectively and these compounds exhibit anti-microbial activity. These two substances can break down the outer membrane of Gram-negative bacteria, releasing lipopolysaccharide and increasing permeability. They can also interact with the Gram-positive bacteria's cell membrane. As a result, bacterial cell membrane loses the integrity and leakage of cellular materials such as nucleic acids, ions, and ATP occurs, thus leading to bacterial cell death (Papadochristopoulos et al., 2021).

**c) Black Pepper**-Piperine is the major bioactive compound present in pepper, and it has the antimicrobial properties. This bioactive compound disrupts the cell membrane as a results leakage of DNA, electrolytes, protein, and ATP occurs, which ultimately causes the death of foodborne bacteria.

**d) Cinnamon**-Cinnamon is a widely used spice around the world. The bioactive components of this spice are cinnamaldehyde and trans-cinnamaldehyde. These active compounds can damage the cell membrane of both gram positive and gram-negative bacteria.

**e) Garlic**-Garlic extract or garlic essential oil contain antimicrobial substance allicin. The allicin is unstable and easily decomposed at the time of processing and forms diallyl disulphide (DAD) and diallyl sulphide (DAS). These active compounds interact with the bacterial cell



membrane and penetrate the bacterial cell, as a result, increase the permeability of the bacterial cell membrane, loss of intracellular materials and cell lysis (dos Santos et al., 2021).

**f) Clove seeds**-Clove is a very common spice used widely as a source of natural preservative and flavoring substance. The active compound of clove is eugenol. In some studies, it is observed that in microbial cell, clove show inhibitory effect in DNA synthesis. The antimicrobial activity of clove against the *Listeria monocytogenes*. The active compound of clove reduces the genetic materials from the bacterial cell by inhibiting the nucleic acid synthesis as a result, damages the cell membrane and causes lysis of the microorganisms.

**g) Nutmeg** -Nutmeg essential oil is a rich source of several active compounds such as  $\alpha$ -pinene,  $\alpha$ -terpineol, 4-terpineol,  $\beta$ -pinene, sabinene and limonene. Nutmeg essential oil retards the lipid oxidation, firmness when applied in meat and preserve the red color of the meat. Nutmeg essential oil shows better efficiency against gram negative bacteria than other spices and herbs.

**h) Turmeric**-Among all the other spices, turmeric is more commonly used as a food preservatives, aromatic stimulant and coloring materials in different food items. Principal bioactive compound of turmeric is curcumin, and it has the antioxidant, antibacterial, anti-inflammatory, anticarcinogenic, antiviral, antifibrotic, antidiabetic, immunomodulatory, antifungal and antiprotozoal properties. It is also observed that curcumin damage the cell membrane of bacteria, as a result, increases the permeability and leads to excessive leakage of cellular materials (Abd El Hack et al., 2021).

**i) Cumin**-Cumin (*Cuminum cyminum*), a spice has several therapeutic properties and cumin seeds are used as a flavoring agent in various food stuff. The active components of cumin essential oil are cymene, terpenoids,  $\alpha$ -pinene and monoterpenes. Among these, monoterpene shows maximum antimicrobial activity by inhibiting the synthesis of proteins and DNA thus causes cell wall deterioration of organisms (Dini et al., 2020).

**j) Coriander**-Coriander is well known for its fragrances and widely used in cosmetic, pharmaceutical and food industry. Besides the fragrances, it also exerts antimicrobial, anti-cholesterol and anxiolytic activity. Active compound of coriander essential oil is Linalool. Linalool increases the permeability of bacterial cell membrane and causes leakage of cellular materials.

**Fruits**-Fruits and their by-products are considered as good sources of vitamins, antioxidants, minerals and fibers due to which consumers are interested to incorporate fruits in their daily diet as health promoting substances. The phenolic content, flavonoids and other antioxidants of fruits make them a good natural preservative for meat and meat products. Among the variety



of fruits, Grapes, Plums, Bearberries, Cranberries, Strawberries and Pomegranates are widely being used by the meat industry (Manassis et al., 2020).

#### **From Microbial origin e.g.- Organic acids, Bacteriocins, etc**

**Organic acids**-Organic acids are the metabolites, majority of which are obtained from natural sources. They are used as a preservative from ancient times to preserve food as they have a great potential to act as antimicrobials, antioxidants, food stabilizers and flavor enhancers etc. in different food items. Citric acid, acetic acid, lactic acid and malic acid are widely used in meat industry as good sources of anti-microbial agents. In addition, they also noticed it preserved the meat color and reduced lipid oxidation during storage (Jaspal et al. (2021).

**Bacteriocins**-Bacteriocins are defined as ribosomally synthesized small polypeptides of LAB, possessing bactericidal activity against other bacteria. The bacteriocin from food grade LAB (nisin, pediocin, lactacin etc.) appear to qualify as ideal food bio-preservative primarily because they are non-toxic to humans/eukaryotic cells (Bhattacharya et al. 2022). Nisin, a bacteriocin produced by *Lactococcus lactis* subsp. *lactis* was the first bacteriocin approved for food use and is the bacteriocin widely employed as a food preservative.

#### **From Animal origin e.g.- Chitosan, Bioactive peptides.**

**Bioactive peptides**-Antimicrobial peptides from plant, animal and microbial origins have a broad range of antimicrobial activities as well as antioxidant activities and thus, used as natural preservatives in meat and meat products. Lactoferrin has been applied in sausage batter's bologna and ground beef.

**Chitosan**-Chitosan is obtained from insect, shellfish, fungal cell wall, algae, protozoa and yeast. The use of a chitosan solution with 1.5% and 29 KDa on sausage fish, improving the quality (preservation of the product) and nutritional aspects of the product (dietary fiber). (Li and Zhuang, 2020). Furthermore, the application of chitosan in the fish sausage resulted in lower counts of total aerobic microorganisms. (Baptista et al., 2020)

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