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Dry-Aged Meat and their Importance

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Abstract

The Bacteria that cause the spoiling may ruin meat, a mainstay in our diets. The Breed, age, feed type, breeding, and aging duration are some of the characteristics that affect tenderness, juiciness, and taste. Wet- or dry-aging are the two aging methods that accommodate customer preferences. While the wet aging supports the lactic acid bacteria, the dry aging encourages the acidic conditions. To optimize the aging process, the microbiology and the technological knowledge are essential.

Keywords: Spoiling; Bacteria; Meat; Wet-or-Dry-Aging

Abbreviations

NGS: Next Generation Sequencing.

Introduction

The Meat is a staple in the human diet since it contains several essential nutrients (lipids and proteins of high biological value) and micronutrients such as iron, zinc, and vitamin B12. Such high nutrient content, coupled with the influence of environmental factors, such as temperature, atmospheric oxygen, endogenous enzymes, moisture, and light; makes meat an excellent substrate for numerous microorganism species to penetrate, grow, and multiply [1-8]. Studies indicate that meat, even from healthy animals, can encounter contamination from the bleeding process to commercialization; with the types of spoilage microorganisms being influenced by storage conditions. The role of the bacterial species in meat spoilage is well established, and the microorganisms found on the meat surface can impact the quality and effectiveness of the aging process [9-16]. Aged meat microbiota may contain the lactic acid bacteria (the LAB), and the mesophilic and the psychrotrophic bacteria; and when in large quantities, force the exclusion of the contaminated meat from sale, causing economic losses to producers and consumers [17-23]. The tenderness, juiciness, and flavor of meat are influenced by factors that include breed, animal age, feed type, breeding, and aging time. In addition to its preservation benefits, the aging process has garnered significant attention in the past decade for its capacity to enhance the sensorial aspects of meat [24-30]. This has led to numerous studies exploring the transformative effects of aging on meat quality. Two aging processes are used to cater to the preferences of the consumer: wet- or dry-aging processes. Notably, both wet-age and dry-age have been found to elevate the quality of diverse beef cuts, indicating the potential for pursuing an optimal method-time and aging combination [31-38]. This suggests that a careful balance of factors can be tailored to meet consumers' preferences and achieve desired beef characteristics. However, factors such as temperature, relative humidity, exposure to forced air, and the group and quantity of microorganisms on the meat surface can interfere with meat quality and yield during aging. More common due to the production yield and convenience of storage and transportation, wet-aging involves sealing meat in vacuum packages and storage in refrigerated temperatures (between - 1°C and 2°C) for a determined period. Dry-aging refers to unpackaged meat cuts kept on open racks in a temperature and humidity [39-46]. Despite possible losses due to evaporation, crust formation, risk of contamination by microorganisms during the process, and the space and materials required, consumers are willing to pay for this expensive product because of its quality and flavor. Since the effects on meat microbiota can be aging method-specific, bacterial diversity should be evaluated. Next Generation Sequencing (NGS) is a broadly used technique to study the bacterial composition of ecosystems, delivering more precise results regarding bacterial diversity. Thus far, few studies have compared traditional microbiology tests with NGS in meat products. Therefore, this study aims to evaluate the bacterial diversity of dry- and wet-aged beef produced in Brazil by Next Generation Sequencing of the 16 S (rRNA) gene and by traditional microbiology testing; comparing their results to understand the diversity with respect to each aging process [45-49]. The aging process plays a significant role in the development of flavor, tenderness, and overall quality of meat. Two primary methods dominate the meat-aging scene, dry-aging and wet-aging.

The Dry-Aging Technology

The Dry-aging involves storing large primal cuts of meat under controlled temperature (typically 1.1-3.3°C) and humidity (70-80%) for extended periods (weeks or months). This environment allows for The Moisture Loss, Evaporation concentrates flavor compounds and tenderizes the meat through enzymatic activity. The Microbial Activity: Psychotropic bacteria like Lactobacillus and Staphylococcus become dominant. LAB convert sugars to lactic acid, lowering the pH and contributing to flavor development and safety [1-7].

The Recent Advancement in the Dry-Aging Technology

The Aging Chambers: Precise control of temperature, humidity, and airflow is crucial. Research is exploring smart chambers with real-time monitoring for optimal conditions.

The Starter Cultures: Introducing specific LAB strains as starter cultures shows promise in promoting consistent flavor profiles and enhancing safety during dry-aging.

The Wet-Aging Technology: The Wet-aging, also known as vacuum-packing, involves storing primal cuts in vacuum-sealed bags at refrigeration temperatures (0-1.67°C) for shorter periods (typically up to 2-3 weeks). This method, Minimizes the Moisture Loss, The vacuum seal retains moisture, resulting in less weight loss but potentially impacting flavor intensity.

The Microbial Growth: The anaerobic environment limits microbial growth, but some psychrotrophs can still proliferate. The Recent Advancement in the Wet-Aging Technology, The Biodegradable Packaging, Sustainable alternatives to traditional plastic vacuum bags are being explored to reduce environmental impact.

The Pressure-Controlled Packaging: Fine-tuning the pressure within the bag might influence moisture retention and microbial growth for optimized wet-aging [18-26].

The Microbiology Comparison

The microbial landscape significantly differs between dry and wet-aged meat, The Dry-Aged, the LAB species like Lactobacillus sakei thrive, creating a more acidic environment that inhibits pathogens and contributes to flavor. The Molds like the Penicillium might also play a role in aroma profiles. The Wet-Aged, Anaerobic bacteria dominate due to the vacuum seal. Lactobacillus presence is lower, resulting in a less pronounced tang compared to dry-aged meat [27-35].

The Safety Considerations

Both dry and wet-aging can be safe practices when proper hygiene is maintained throughout the process. The low temperatures and (in dry-aging) reduced pH create an inhospitable environment for pathogens. The choice between dry and wet-aging depends on desired outcomes. The Dry-aging offers a more intense flavor profile and improved tenderness but comes with higher weight loss. Wet-aging provides a more controlled environment with less weight loss but may result in a milder flavor. Understanding the interplay between technology and microbiology is crucial for optimizing the aging process and achieving the best possible quality in the final product [35-42].

The Dry and wet aging methods influence the microbial ecology of The meat, impacting safety and The spoilage, The Microbial Landscape, The Pathogens, Both methods can harbor potential pathogens like E. coli, Salmonella, Listeria monocytogenes, etc., if not controlled properly. Studies suggest the dry-aging might reduce some pathogens. No Salmonella could be found in either dry or wet-aged beef after 30 days. Listeria may not survive well due to drying in the dry-aging [43-49]

The Spoilage Bacteria

The Dry-aging promotes specific spoilage bacteria like Pseudomonas and Brochothrix. The Wet-aging favors lactic acid bacteria like Lactobacillus [31-37].

The Factors at play in the Dry-Aging

The low humidity environment (75-85%) and airflow inhibit some bacteria while the favoring drying on the surface, which some studies suggest might limit pathogens. The Wet-

Aging: The vacuum packaging maintains moisture, favoring some spoilage bacteria but potentially limiting surface growth. The Wet-Aging Technology Both methods can be safe with proper hygiene and controlled conditions (temperature, time).The Dry-aging might offer some advantages in reducing pathogens due to drying, but research is ongoing [18-26].

Conclusion

The aging process, whether it is the dry-aging or wet-aging, plays a significant role in the development of the flavor, the tenderness, and overall quality of the meat. The Dry-aging involves storing large primal cuts of meat under controlled temperature and humidity for extended periods, allowing for moisture loss and microbial activity. The Wet-aging, on the other hand, involves storing primal cuts in vacuum-sealed bags at refrigeration temperatures for shorter periods, minimizing moisture loss and limiting microbial growth. The choice between the dry and wet-aging depends on desired outcomes, with the dry-aging offering a more intense flavor profile and improved tenderness but higher weight loss, while wet-aging provides a more controlled environment with less weight loss but a milder flavor. Understanding the interplay between technology and microbiology is crucial for optimizing the aging process and achieving the best possible quality in the final product.

Conflicts of Interest

The author declare no conflicts of interest

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