UNIVERSITY OF LIFE SCIENCES
"KING MIHAI I" FROM Timisoara

Multidisciplinary Conference on Sustainable Development

15 – 16 May 2025

FACTORS INFLUENCING THE QUALITY OF CHICKEN MEAT: A REVIEW

Ștefan Teofil VLAD[1], Stefania Iuliana BORDEI (BOLOLOI)[1], Georgiana Magdalena (GHECIU PIRLEA)[1], Daniela IANITCHI[1], Marius Laurian MAFTEI[1], Daniela-Mihaela GRIGORE[1], Andrada Elena MOISE[1], Ioan CUSTURA[1], Minodora TUDORACHE[1]

[1] University of Agronomic Sciences and Veterinary Medicine of Bucharest, Faculty of Engineering and Management of Animal Production, Department of Production and Processing, e-mail: teovlad187@yahoo.com

Abstract: Poultry meat quality is increasingly important due to rising global consumption and consumer demands for nutrition, safety, and taste. This review highlights key factors affecting meat quality, including genetics, nutrition, environment, and processing practices. While breeding for fast growth boosts efficiency, it also causes defects like PSE, white striping, and woody breast. Nutrition and stress management are crucial for muscle health and product stability. Additionally, production systems—free-range vs. intensive—impact meat texture and nutritional value. An integrated approach is essential to improve quality across the poultry supply chain.

• Introduction

Poultry meat production has grown rapidly, surpassing traditional meats like pork and beef, with global output expected to exceed 139 million metric tons in 2023. This growth is largely driven by countries like Brazil, the U.S., and China, with chicken meat dominating exports. The poultry sector's global share rose from 8.3% in 1985 to 26.57% in 2021, reflecting rising demand due to economic development, health awareness, and preferences for organic, antibiotic-free products.

However, intensive farming has introduced challenges affecting meat quality, including visual defects and health issues caused by poor management, heat stress, and feed contamination. In response, scientific efforts focus on improving genetics, feed efficiency, and welfare standards. Strategies like using probiotics, prebiotics, and natural plant-based additives have shown promise in enhancing meat quality, supporting animal health, and meeting consumer expectations for safer, more sustainable poultry products.

• Material and method

This paper provides a critical review of recent scientific literature on the factors influencing poultry meat quality. Data were gathered from international databases such as ScienceDirect, PubMed, Scopus, and Web of Science using targeted search terms related to meat quality, rearing systems, sensory attributes, safety, and storage. The review includes experimental studies, meta-analyses, and official guidelines from global health authorities (e.g., USDA, EFSA).

The analysis focused on key quality parameters: chemical composition, sensory traits (color, tenderness, juiciness, flavor), microbiological safety, and shelf life. Rather than conducting original experiments, the study offers a comparative interpretation of existing findings, emphasizing how different rearing systems—intensive, free-range, and organic—affect final product quality. The paper aims to provide an integrative synthesis valuable for researchers, producers, and policymakers in animal science and food safety.

• Results and discussions

1. ***Meat Color***

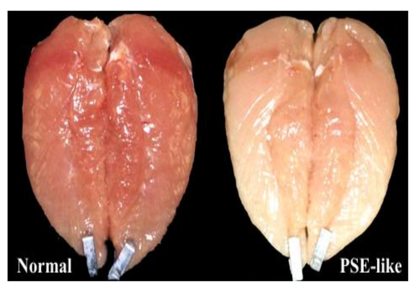

Figure 2. Pale, soft and exudative (PSE)-like broiler breast meat. https://pmc.ncbi.nlm.nih.gov/articles/PMC3277097/

Meat color is a primary visual quality indicator for consumers and often associated with freshness. The pigment composition, especially myoglobin and hemoglobin, determines color variations and is influenced by genotype, age, diet, and rearing conditions. Fast-growing broilers typically have paler meat due to lower myoglobin content, while slower-growing or free-range birds exhibit darker, more reddish meat, especially in the thigh area. Environmental exposure, carotenoid-rich diets, and physical activity intensify pigmentation. Meat pH also plays a role: low pH leads to pale meat (PSE), while high pH results in darker tones (DFD).

2. *Meat Tenderness and Juiciness*

Tenderness is essential for consumer satisfaction and is shaped by muscle structure, connective tissue maturity, and postmortem biochemical events such as rigor mortis and proteolysis. Birds raised in organic or free-range systems, or those slaughtered at older ages, tend to produce tougher meat due to increased collagen density. Muscle pH significantly affects texture—meat with low pH can become excessively soft, while high pH results in firmness. Juiciness, closely linked to water-holding capacity and intramuscular fat, is reduced in lean meat like that of fast-growing broilers, especially if overcooked. Myopathies such as wooden breast and white striping further diminish meat quality.

3. *Meat Flavor*

Flavor develops primarily during cooking through Maillard reactions and lipid oxidation, producing volatile compounds responsible for the aroma and taste of poultry. Fat content and composition directly influence flavor intensity, with birds containing more intramuscular fat producing richer aromas. Free-range and organic birds, due to diverse diets and exercise, often exhibit more pronounced, "gamey" flavors preferred by some consumers. However, excessive omega-3 fatty acids from fish-based feeds may impart fishy notes, particularly in thigh meat. Meat pH and proteolysis also influence flavor compound development, and antioxidant supplementation can help preserve flavor stability.

4. *Meat pH*

- The ultimate pH of meat (pHu) reflects postmortem glycolysis and affects multiple quality traits including texture, color, WHC, and shelf life. Optimal pHu in poultry meat ranges from 5.8 to 6.3. Below this range, meat becomes pale and exudative (PSE); above, it becomes dark and firm (DFD). Factors such as bird genotype, stress prior to slaughter, and rearing system affect pH outcomes. Free-range or organic birds, due to their higher activity and lower stress levels, often exhibit lower muscle pH. Managing stress and chilling procedures post-slaughter are essential to maintain ideal pH levels for meat quality.

5. *Chemical Composition (Protein and Fat Content)*

- Rearing systems strongly influence the nutritional makeup of broiler meat. Free-range and organic birds typically have leaner meat with higher protein and lower fat content due to greater activity and less energy-dense diets. In contrast, intensively reared birds gain weight rapidly and accumulate more fat, especially abdominal and intramuscular fat, which can negatively affect both taste and consumer health perception. Though protein levels in breast meat remain high across all systems, free-range birds offer a slightly better nutritional profile due to lower fat content and higher muscle development.

6. *Fatty Acid Profile and Cholesterol*

- Free-range and organic poultry meat generally shows a healthier lipid profile, with increased levels of polyunsaturated fatty acids (PUFAs), particularly omega-3s, due to diets that include forage, insects, and organic feeds like flaxseed. These fats contribute to heart health and are desirable from a nutritional standpoint. However, higher PUFA content can make the meat more prone to oxidation, which affects flavor and shelf life. Cholesterol content varies by cut and system, but in general, alternative systems tend to produce meat with lower total fat and cholesterol levels, making them more suitable for health-conscious consumers.

7. *Microbiological Quality and Food Safety*

- Different rearing environments expose poultry to distinct microbiological risks. Free-range and organic birds, having access to outdoor spaces, face a higher risk of contamination from Campylobacter and other environmental pathogens. However, improved gut microbiota diversity in these systems may enhance resistance to some bacteria. In contrast, conventional systems reduce environmental exposure but risk internal outbreaks due to crowding. Ultimately, proper hygiene, processing, and biosecurity measures are critical across all systems to ensure that final meat products are microbiologically safe for consumers.

8. *Spoilage and Shelf Life*

- Spoilage patterns vary slightly depending on pH, microbial flora, and antioxidant presence. Meat with higher pH is more prone to bacterial spoilage, though free-range meat may benefit from lower pH due to pre-slaughter stress and higher antioxidant intake. Despite initial microbial differences, studies show that with appropriate processing and refrigeration, shelf life does not differ significantly between rearing systems. Efficient cold-chain logistics and hygiene practices remain the most important factors in extending shelf life, regardless of production system.

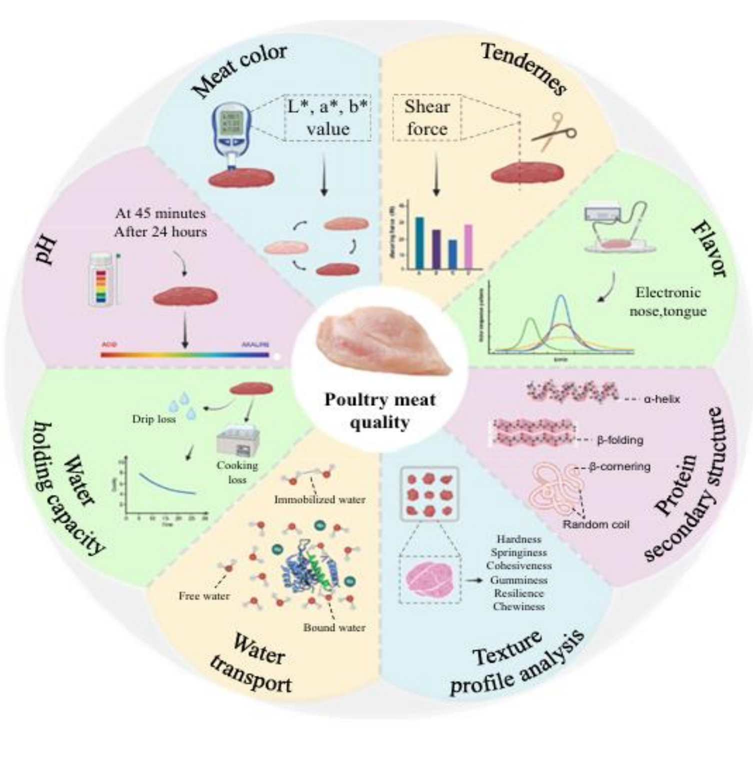

Fig. 1. Poultry Meat Quality Evaluation Indexes
This comprehensive diagram illustrates the multifactorial approach to evaluating poultry meat quality, structured into eight main sections, which include: meat color, pH, water holding capacity, water transport, texture profile analysis, protein structure, flavor, and tenderness. (https://app.biorender.com/).

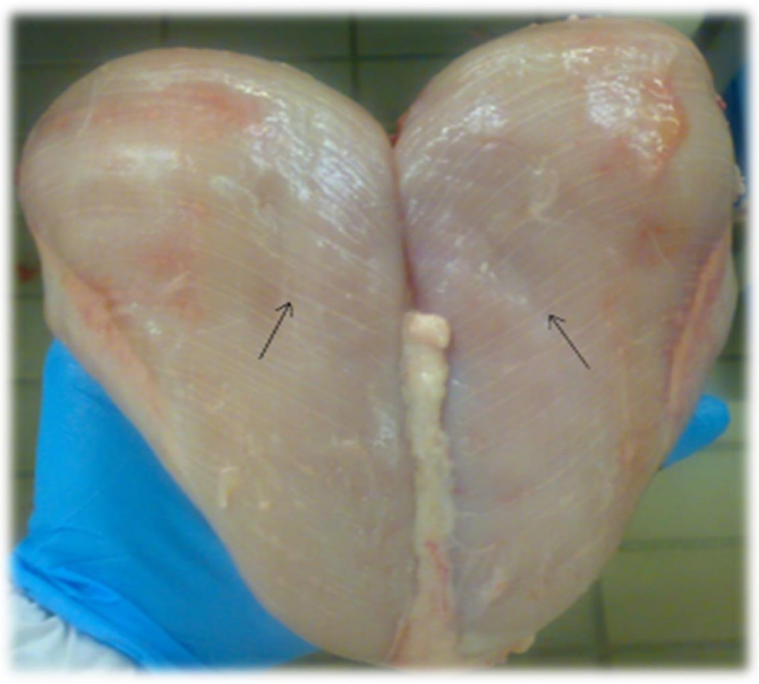

Figure 3. Broiler breast meat with "white striping" defect.

https://pmc.ncbi.nlm.nih.gov/articles/PMC3277097/

• Conclusions

The global growth in poultry meat production is driven by economic factors and consumer demand for lean, affordable, and health-oriented protein. However, this expansion, primarily achieved through intensive genetic selection and efficient farming systems, has brought challenges in meat quality, animal welfare, and sustainability.

Broiler meat quality results from a complex interaction of genetics, nutrition, rearing conditions, and processing. While genetic improvements have boosted growth and feed efficiency, they have also led to muscle abnormalities such as white striping, wooden breast, and spaghetti meat, which negatively affect texture, water retention, and consumer acceptance.

Key quality traits like color, tenderness, juiciness, flavor, and pH are influenced by both internal factors (genotype, sex, age) and external ones (diet, housing, pre-slaughter handling). Free-range and organic systems often produce meat with better nutritional value but pose higher microbial risks. In contrast, intensive systems are efficient but may require technological solutions to maintain quality.

Microbiological safety and antibiotic resistance vary across systems; antibiotic-free models show lower resistance issues but face increased contamination risks. Therefore, strong biosecurity and hygiene practices are essential across all systems.