

Poultry Meat: Nutritional, Sensory and Commercial Analysis from Production to Consumption

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Abstract

The nutritional, sensory, and commercial value of poultry meat has positioned it as a key component in the modern food system. This study investigates the interconnected dimensions that contribute to the overall quality and relevance of poultry meat, providing a comprehensive overview of its benefits and challenges within the current agri-food context.

Nutritionally, poultry meat is a high-quality source of protein with excellent digestibility and bioavailability. It contains essential amino acids, a favorable lipid profile low in saturated fats and rich in polyunsaturated fatty acids, as well as important micronutrients such as selenium, iron, and B-complex vitamins. These characteristics make it a valuable option for promoting balanced diets and preventing nutrition-related disorders.

From a sensory perspective, consumer perception is strongly influenced by traits such as tenderness, flavor, juiciness, and visual appeal. These attributes depend on several intrinsic and extrinsic factors, including breed, feeding practices, slaughter age, and processing technologies. Enhancing sensory quality is essential to increase consumer acceptance and satisfaction.

Commercially, poultry meat holds a strong position in global markets due to its affordability, production efficiency, and adaptability to consumer demands. The development of value-added products, such as functional foods and convenience items, continues to expand its economic potential. Moreover, sustainability concerns and changing dietary patterns are driving innovation in both production and marketing strategies.

This paper highlights the need for a multidimensional evaluation of poultry meat, integrating nutritional value, sensory appeal, and market performance. Such an approach supports the optimization of product quality, aligns with public health goals, and enhances competitiveness within the food industry

Keywords: alternative protein sources, feed composition, post-mortem processing, poultry meat quality, sensory analysis, sustainability in poultry production

1. Introduction

Poultry meat (mainly chicken and turkey) has become a staple food in the global diet over the past decades, distinguished by a rapid increase in both production and consumption at the international level [1]. According to data published in 2023, global poultry meat production was estimated to exceed 139 million tons, marking

a growth of approximately 3% compared to 2022, driven by the accelerated expansion of the poultry industry in regions such as Brazil and the United States [2].

This upward trend has positioned poultry meat as the most consumed type of meat globally, surpassing pork and beef. For example, in the United States, chicken consumption has tripled compared to 1960, reflecting a major shift in eating behaviors [3, 4]. The popularity of this type of meat is attributed both to the general perception of its nutritional benefits especially its high protein content and lower fat levels compared to

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other meats and to its economic affordability and culinary versatility [5].

In parallel with the increase in consumer demand, the poultry industry has undergone profound modernization, marking a significant intensification of production processes. Modern meat chickens (broilers) reach optimal slaughter weight (approximately 2.5 kg) in just 6 weeks, compared to about 110 days a century ago to reach a weight of 1.2 kg. This increased efficiency has been made possible by genetic improvement, advances in animal nutrition, and enhanced livestock management practices [6].

At the same time, transformations in the industry have led to a diversification of the range of marketed products: from the traditional sale of whole birds to a wide array of cut and processed products such as boneless chicken breast, wings, and nuggets which respond to the increasing consumer preference for convenient, ready-to-cook products [7]. Additionally, processing capacity has grown significantly: modern slaughterhouses can process up to 15,000 birds per hour, compared to 2,500 birds per hour just a few decades ago. This intensification of processing imposes high standards for bird uniformity in terms of size, color, and texture, in order to match the requirements of automated production lines [8].

An analysis based on national statistical data highlights the dynamics of meat consumption in Romania between 2014 and 2020. A significant increase in poultry meat consumption is observed from approximately 20 kg/year to 28 kg/year (+39%) compared to an increase from 30 kg/year to 38.3 kg/year (+28.6%) in the case of pork, which still maintains a higher overall consumption volume [9].

As poultry production has intensified, challenges related to maintaining and improving product quality have emerged. Today, consumers no longer prioritize price alone but pay increased attention to the sensory and nutritional quality of meat, as well as the production methods used particularly regarding animal welfare, antibiotic use, and environmental impact [10]. These considerations lead farmers and processors to continuously optimize technological practices and rearing conditions to obtain carcasses that are visually attractive (free of scratches, bruises, or uneven pigmentation) and of high internal meat quality.

Additionally, the accelerated growth rate of modern broiler chickens has led to a higher prevalence of certain muscle myopathies, such as "woody breast" and "white striping," which negatively affect the texture, nutritional composition, and appearance of chicken breast. These muscle conditions are a major concern in the poultry industry, having direct implications for consumer acceptance and the commercial value of the meat [11].

Given these considerations, this review aims to provide a comprehensive and up-to-date analysis, based on recent scientific literature, of the key dimensions influencing poultry meat quality, from production to consumption.

2. Materials and methods

This review draws on a broad analysis of scientific literature covering the nutritional, sensory, and commercial dimensions of poultry meat quality. Sources were identified through major academic databases: Scopus, Web of Science, PubMed, ScienceDirect, and Google Scholar and span publications from 2014 to 2024.

The search included peer-reviewed journal articles, academic monographs, conference proceedings, doctoral theses, and institutional reports from organizations such as FAO, EFSA, the European Commission, and USDA. To provide local context, national data from Romania's National Institute of Statistics (INSSE) were also included.

Studies were selected based on the following inclusion criteria: data on the nutritional and chemical composition of poultry meat, evaluation of sensory attributes, including tenderness, juiciness, flavor, and color, assessment of genetic, nutritional, and technological influences on meat quality, analysis of alternative protein sources in poultry diets (e.g. insects, microalgae, legumes, agro-industrial by-products), indicators related to market value, consumer perception, and sustainability

The gathered materials were thematically organized and comparatively reviewed to highlight key trends, recurring findings, and knowledge gaps. Priority was given to recent, high-quality studies that contribute to understanding the complex factors shaping poultry

meat quality in the context of sustainable agri-food systems.

3. Results and discussion

Sensory Analysis of Poultry Meat Quality

The sensory quality of meat is defined by the totality of its attributes perceived by the human senses primarily texture (tenderness and juiciness), aroma, flavor, and visual appearance [12]. In poultry meat, as in other types of meat, tenderness is one of the most important organoleptic parameters, significantly influencing consumer satisfaction.

Tenderness refers to the resistance of the meat to mastication and results from the complex interaction of both ante-mortem factors (related to the bird and its growth conditions) and post-mortem factors (associated with meat processing immediately after slaughter) [13]. The structure of muscle and connective tissues has a direct impact on perceived tenderness. Elements such as collagen content and quality, the distribution of intramuscular fat, and the diameter of muscle fibers and bundles all contribute to meat texture, as shown in Figure 1, which illustrates the structure of a muscle fiber and its impact on meat tenderness [14].

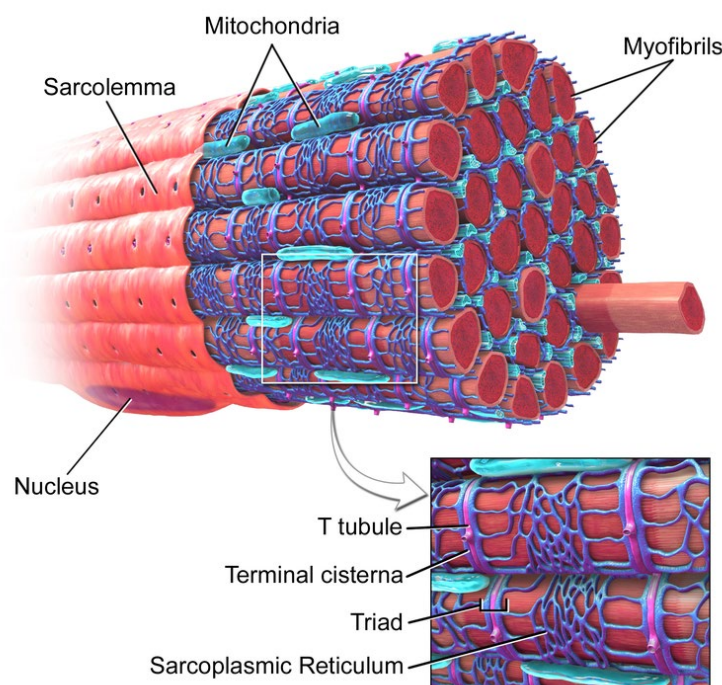


Figure 1. Structure of a muscle fiber and its components. Cross-sectional and longitudinal view of a skeletal muscle fiber showing the sarcolemma, myofibrils, mitochondria, and sarcoplasmic reticulum.

This anatomical structure is essential in understanding meat tenderness

https://en.wikipedia.org/wiki/Skeletal_muscle

Species, breed, age, and sex also play important roles: meat from younger birds is generally more tender than that from older birds, and species such as chickens and fish are typically more tender than pork, which is itself more tender than beef. However, since most broiler chickens are slaughtered at a young age (5–7 weeks), differences in tenderness due to age or sex are usually minimal [15]. Key factors influencing the tenderness of poultry meat include:

Post-mortem maturation the aging process involves slow proteolytic degradation of contractile proteins by endogenous enzymes.

This natural tenderization improves meat consistency in the first few days post-slaughter [16].

Conditions during rigor mortis the degree of muscle contraction and temperature during rigor mortis significantly affect final texture [17]. Rapid carcass chilling (below 10°C) before rigor can

cause cold shortening, leading to tough meat, while high temperatures can lead to hot shortening. The optimal temperature for rigor mortis in poultry is approximately 15°C [18]. Technological interventions such as electrical stimulation immediately post-slaughter or pelvic suspension have proven effective in mitigating contraction and enhancing tenderness [19, 20].

Connective tissue composition collagen provides structural resistance to the muscle. The quantity, distribution, and thermal stability of collagen vary across muscle groups and with age. Muscles that undergo sustained activity (e.g., drumsticks) contain more collagen and are less tender than less active muscles (e.g., breast) [21]. In younger birds, collagen is more soluble, thereby improving tenderness [22].

Intramuscular fat although not always visible, a moderate amount of intramuscular fat can enhance both juiciness and tenderness. Low fat content may result in drier meat, while a moderate level facilitates lubrication during mastication [23]. Feeding strategies can influence intramuscular fat deposition and enzymatic activity related to post-mortem tenderization, though this impact is relatively limited in modern broilers [24].

Beyond tenderness, juiciness is another essential sensory attribute. It refers to the perception of moisture and softness during chewing and is closely linked to water-holding capacity and fat content. A slightly higher post-mortem pH enhances water retention in muscle fibers, while pre-slaughter stress may cause rapid acidification and fluid loss, similar to the PSE (pale, soft, exudative) condition seen in pork. Stocking density also plays a role; lower densities have been associated with reduced intramuscular fat but also lower cooking losses, indicating potentially juicier and more efficient meat yield [25, 20].

In industrial practice, methods such as marination (via injection or immersion in brine with seasonings) are widely used to enhance both juiciness and tenderness by increasing water retention and modifying protein structure.

The aroma and flavor of poultry meat are typically milder compared to red meats. These sensory characteristics are primarily developed during cooking through the release of volatile compounds from fats and Maillard reactions between amino acids and sugars [26]. Poultry diet subtly

influences flavor: for instance, fishmeal can impart a slightly off-putting odor, while corn-based diets enhance a sweet flavor and yellow hue in skin and fat (due to xanthophyll content) [27]. Diets rich in green forages or antioxidants such as vitamin E can also improve flavor and oxidative stability [28].

The appearance of poultry meat is critical for consumer acceptance. Raw breast meat typically has a pale pink color, while drumsticks are darker due to higher myoglobin content [29]. Pre-slaughter stress and handling may alter these colors severe stress can cause dark, firm, dry (DFD) meat, whereas moderate stress may lead to rapid pH decline and result in pale, soft, exudative (PSE) meat [30]. Post-mortem chilling and storage conditions also influence meat color and microbiological stability. Rapid cooling helps preserve a bright, fresh appearance and reduces bacterial growth [31].

The sensory quality of poultry meat is shaped by a multitude of factors that require careful control ranging from bird welfare and nutrition to post-mortem processing and retail conditions. Only through an integrated approach can producers consistently deliver poultry products that meet consumer expectations for taste, texture, and visual appeal.

Alternative Feeding and the Impact on Meat Quality

In the context of the doubling of feed requirements to support the expansion of poultry meat production, identifying and utilizing alternative feed sources becomes a strategic priority. Traditional feeding of broiler chickens is mainly based on corn (as an energy source) and soybean meal (as the primary protein source) (Figure 2) [32]. Soy is valued for its high protein content (approximately 44–48% in soybean meal) and its amino acid profile, which complements cereals.

However, global dependence on this resource raises a number of concerns: price volatility, the contribution of soybean crop expansion to deforestation (e.g., in the Amazon), and the widespread use of genetically modified soy, which raises concerns among some consumers and policymakers [33].

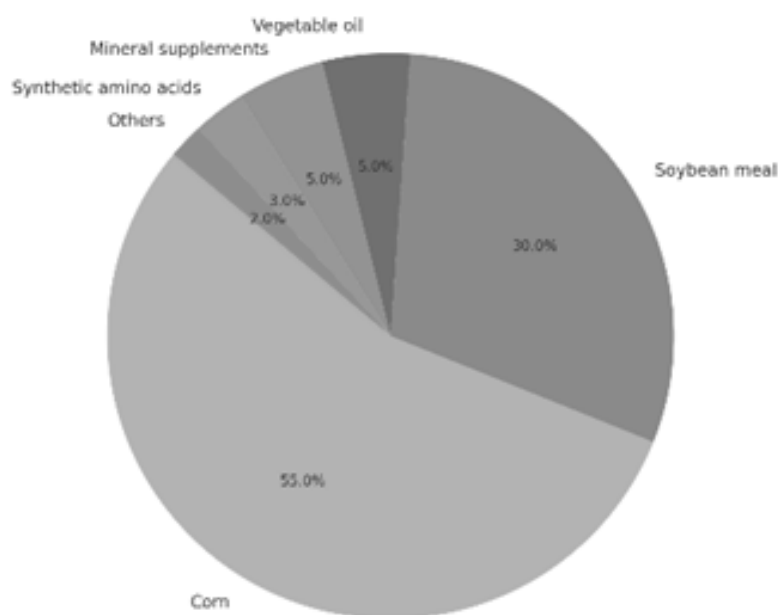


Figure 2. Composition of a typical broiler chicken feed.

Corn represents the main energy source, while soybean meal provides the primary protein input. The formulation also includes vegetable oil, mineral supplements, synthetic amino acids, and other micronutrients
<https://www.feedstrategy.com/animal-feed-formulations-library/traditional-us-broiler-feed-formulations>

Moreover, the competition for agricultural land use between human food production and animal feed, as well as uncertainties in supply (especially in net-importing countries such as Romania), has driven research into alternative ingredients [34].

Conventional and Unconventional Protein Sources in Poultry Feeding

In addition to soybean meal, other conventional protein sources used in poultry feed include rapeseed meal, fishmeal, peas, and other legume seeds, each with advantages and limitations. For example, rapeseed contains 35–40% protein and can partially replace soy, but the presence of antinutritional factors (glucosinolates) and higher fiber content limits the optimal inclusion rate [35]. In recent years, scientific studies have increasingly focused on unconventional protein sources to reduce reliance on traditional resources (soy, fish), while ensuring adequate nutrition, controlled costs, and reduced environmental impact.

Among these alternative protein sources are:

Insects – Larvae of insects such as the black soldier fly (*Hermetia illucens*) or mealworms (*Tenebrio molitor*) can be grown on residual substrates and can be incorporated into poultry

diets in multiple forms whole, dried, or processed into protein meal or oil [36].

Their production is typically based on organic waste substrates, contributing to circular economy strategies in animal nutrition (Figure 3) [37].

Insects have a high protein content (40–60%) and a favorable amino acid profile but also contribute significant fat levels (particularly saturated fatty acids such as lauric acid) [38]. Recent research indicates that including insect meal in broiler feed at levels up to 10–15% does not negatively affect growth performance or meat quality parameters. For instance, a study using *Hermetia illucens* larvae showed that replacing up to 20% of soybean meal with insect meal did not significantly affect meat pH, color, cooking losses, or tenderness; only changes in meat composition were noted at the 20% level, increases in saturated fatty acids (lauric, myristic) and certain muscle amino acids were observed [39]. Another study [40] reported that replacing 50% of soybean meal with whole *Hermetia* larvae meal led to a reduction in fat and collagen content in chicken breast (indicating leaner and potentially more tender meat) compared to batches with higher insect content. However, at a 100% replacement

level, there was an increase in saturated fatty acids and a decrease in polyunsaturated fatty acids in the meat, which diminished its nutritional value [40]. Therefore, insects represent a promising

alternative ingredient, but their inclusion level must be optimized – including through defatting insect meal to reduce saturated fat content.

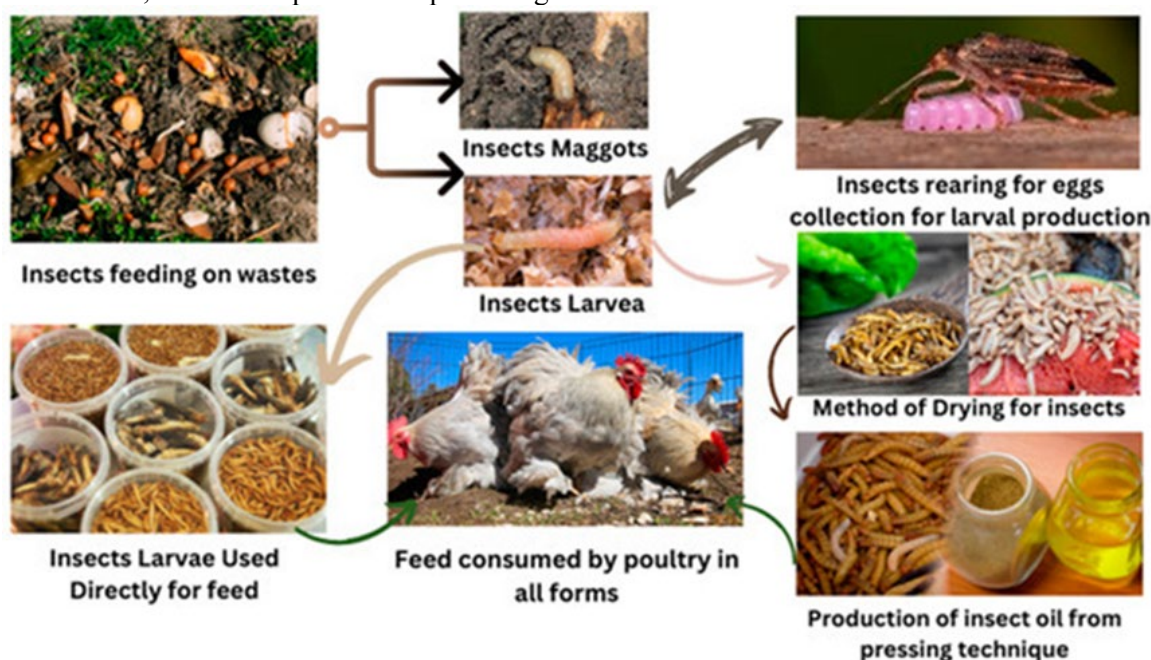


Figure 3. Insect-based poultry feed production chain.

Flowchart illustrating the conversion of organic waste into insect larvae and derived products (dried larvae, insect meal, oil), all used as feed ingredients for poultry
<https://doi.org/10.3390/agriculture13061239>

Microbial (Single-Cell) Proteins Yeasts (e.g., *Candida utilis*), unicellular algae (such as spirulina, chlorella), and bacteria can be grown on inexpensive substrates (molasses, fermentable agricultural waste) to produce protein-rich biomass. Spirulina, for example, contains over 60% protein and has been tested in broiler diets at low concentrations, with some improvements in meat color observed (due to pigments that can give the skin and fat a yellowish tint), without negatively impacting meat quality [41]. These proteins do not require agricultural land and can be produced year-round, though palatability and cost can be obstacles. High-Protein Plants (Legumes, Oilseeds) - Peas, fava beans, lupins, sunflower meal, cottonseed meal, and peanut meal are promising plant-based alternatives to soy [42]. Fava beans (*Vicia faba*), with a protein content of about 26–30%, have been successfully used in poultry diets, especially in combination with potato protein and yeast to balance the amino acid profile, yielding meat quality comparable to that achieved with traditional soy-based diets [8]. In a comparative study, replacing soybean meal with

various legumes (rapeseed, white and yellow lupins, peas, fava beans) resulted in slightly lower growth performance but only minor changes in meat composition [43]. Specifically, rapeseed meal and fava beans led to lower fat content in the meat and a slightly higher muscle yield. Meat from chickens fed fava beans, supplemented with potato protein and yeast, had similar quality to that from soy-fed birds, suggesting that fava beans are among the most promising legumes for partial soy replacement.[8, 43] Sweet lupins (a variety with reduced alkaloid levels) contain 35–40% protein; up to 20% lupin meal in the diet does not negatively affect carcass or meat quality, although higher levels may slightly reduce tenderness due to fiber and residual antinutrients [44].

Industrial By-Products – By-products from the biodiesel industry (e.g., Camelina meal), dried distillers grains with solubles DDGS – from ethanol), processed meat and bone meal (where legally allowed), bakery or pastry residues, etc., represent viable means of circular resource valorization. These by-products can supply protein and energy at low cost. For example, corn DDGS

has a protein content of about 25–30% and can replace 5–10% of the diet without adverse effects, potentially increasing the content of unsaturated fatty acids in meat due to residual corn oil [45]. However, the variability in by-product composition and the potential presence of mycotoxins (especially in meals) require caution and quality control [46].

Integration of These Alternative Sources must be assessed in terms of their impact on meat quality. In general, research shows that most alternative ingredients, when properly balanced to supply all essential amino acids and avoid antinutrients, do not compromise poultry meat quality. For instance, partial replacement of soybean meal with high-protein soybean concentrate (which contains more protein), in proportions of 4–12%, did not result in significant differences in meat quality parameters (pH, color, tenderness), according to a study by Zhang et al. (2021) [47]. Similarly, the use of insects or legumes tends to have minor effects on organoleptic characteristics, as long as growth performance is not severely affected. However, there are trade-offs: some ingredients may slightly alter meat or fat color. For example, alfalfa or cassava leaf meal (studied in certain regions as protein sources) contain carotenoid pigments that may give a yellowish hue to the meat and skin – a trait sometimes perceived positively by consumers, who associate it with natural feeding or floor-raised poultry. Conversely, full-fat insect meal can lead to a firmer and yellower fat layer due to its natural pigments. Sources rich in natural antioxidants (e.g., spirulina, grape seed meal rich in polyphenols) can improve meat oxidative stability, extending shelf life by slowing fat rancidity. In contrast, some by-products may introduce undesirable flavors (e.g., brewers' spent grains can impart a slightly sweet odor) [48, 49]. Overall, well-planned alternative feeding can support sustainable poultry meat production without compromising quality. The key lies in maximizing the use of local and sustainable ingredients, while ensuring the nutritional balance of the poultry diet and monitoring potential effects on meat characteristics. This requires close collaboration between nutritionists, food industry technologists, and economists to identify the most suitable combination in terms of both quality and cost-effectiveness.

Commercial Aspects and Sustainability

The poultry meat industry has experienced significant growth in recent decades, becoming one of the most dynamic sectors in agriculture. From a commercial perspective, poultry meat is attractive due to its relatively low production costs compared to other meats and the consistently strong consumer demand. Broiler chickens exhibit the most efficient feed conversion ratio (approximately 1.5–1.8 kg of feed per 1 kg of live weight gain), a value superior to that of cattle or even pigs, which translates into lower costs per unit of meat produced [50]. Additionally, the short production cycle (around 6 weeks from hatching to slaughter) allows for rapid rotation and relatively easy adaptation to market demands. These economic advantages make poultry meat the most affordable source of animal protein for consumers in many countries [51].

From a commercial value standpoint, meat quality plays a crucial role. Producers aim to obtain carcasses with high breast yield (considered the most valuable cut), a visually appealing appearance (light color, free of defects), and parameters that ensure extended shelf life (optimal pH, low microbial load). The occurrence of defects such as *white striping* or *woody breast* has direct financial implications: moderately or severely affected fillets are redirected to processed products (e.g., nuggets or deli meats) or, in some cases, removed from the supply chain, leading to losses or additional processing costs [52]. Therefore, there is significant commercial interest in selecting genetic lines and rearing practices that reduce the incidence of such quality issues.

In recent years, some producers have started marketing slower-growing chicken breeds (such as Hubbard Redbro) or birds raised in extensive, rural systems, capitalizing on consumer interest in higher-quality products and animal welfare. These products, often labeled as “farm-raised,” “free-range,” or “organic,” are sold at premium prices, segmenting the market based on purchasing power and ethical preferences [53].

Another key commercial factor is food safety. The sanitary quality of poultry meat (absence of pathogens like *Salmonella* or *Campylobacter*, and no antibiotic residues) is strictly regulated and monitored. Food safety scandals or alerts can severely impact sales and public trust. For this reason, the commercial sustainability of the sector depends on investments in biosecurity, disease

control, and practices that reduce antibiotic use (such as antibiotic-free programs and the use of probiotics or vaccines as alternatives). A 2019 study showed that 90% of broiler chickens in intensive U.S. farms came from just two highly efficient genetic lines (Cobb 500 and Ross 308). This genetic uniformity, driven by economic considerations, poses risks a particular disease or nutritional deficiency could affect most flocks in the same way. Therefore, diversifying genotypes and maintaining a varied genetic pool are sustainable long-term strategies [54].

Sustainability in poultry meat production encompasses economic, environmental, and social dimensions. From an environmental point of view, broiler chickens generate a lower carbon footprint and consume fewer resources per unit of edible protein than most other farm species. Life cycle analysis studies have shown that greenhouse gas emissions per kilogram of chicken meat are around 6–7 kg CO₂ equivalent – significantly lower than for beef (20–30 kg CO₂e/kg) or pork (around 8–12 kg CO₂e/kg). This, combined with high feed conversion efficiency, makes the poultry industry relatively environmentally friendly compared to others [55].

However, there are also specific environmental challenges: waste management (poultry manure is rich in nitrogen and phosphorus and can cause water pollution if not used responsibly as fertilizer), local air quality (ammonia emissions in housing), and dependency on cultivated resources (soy, corn). Toward sustainability, circular solutions are being implemented – for instance, using organic waste to raise insects for poultry feed or installing solar panels and other renewable energy sources on farms.

Animal welfare is an important aspect of social sustainability. Especially in Europe, consumers are increasingly concerned about how animals are raised, demanding higher welfare standards. For broiler chickens, welfare issues include high stocking densities, potential locomotor problems in fast-growing breeds (due to accelerated growth, chickens may develop deformities or joint pain), and lack of access to outdoor areas or natural light in intensive systems. In response, some countries and retailers have implemented voluntary standards such as: reducing stocking density, providing environmental enrichment (straw bales, elevated resting platforms, filtered natural light), and using slower-growing breeds (which require

30–40% more time to reach slaughter weight) – all of which improve welfare but also increase production costs [39].

Interestingly, studies suggest that slow-growing breeds not only have fewer welfare issues but also produce meat with a different sensory profile: higher protein and PUFA content, lower pH (indicating better aging), and often a more intense flavor compared to industrial fast-growing lines [56]. This creates a potential quality niche, where social sustainability (via improved welfare) aligns with premium product quality.

From the market and consumption perspective, poultry meat has become a staple food in many populations, surpassing beef consumption globally. This popularity comes with responsibility: ensuring sustainability throughout the value chain from farm to fork. Recent initiatives include reducing food waste (full carcass utilization through by-products like concentrated soup stock from bones, protein snacks from chicken skin, etc.), adopting more environmentally friendly packaging, and transparent labeling (clearly indicating rearing systems – industrial, floor-raised, free-range, organic). Furthermore, emerging competition from alternative proteins (e.g., plant-based “chicken” made from soy or pea, or future cell-cultivated meat) is prompting the poultry industry to highlight its strengths: natural product attributes, relatively low environmental footprint compared to other meats, and ongoing improvements in welfare and quality [57].

From both commercial and sustainability perspectives, the poultry meat sector continues to evolve to meet growing demand while maintaining economic competitiveness and reducing environmental impact. Innovations in nutrition (alternative feeding), genetics (breeds more resistant to disease and with fewer quality defects), and management (sustainable, welfare-oriented practices) will continue to play a key role in ensuring this primary source of animal protein remains viable long-term, offering consumers a safe, affordable, and high-quality product.

4. Conclusions

Poultry meat remains one of the most efficient, accessible, and sustainable sources of animal protein worldwide. Its nutritional value and

production efficiency make it a cornerstone of global food security. But sustaining and improving meat quality demands an interdisciplinary approach combining animal science, nutrition, genetics, technology, and environmental management.

Feed formulation plays a central role in shaping both the nutritional profile and sensory quality of meat. Introducing alternative proteins such as insect meal, microalgae, and locally grown legumes helps reduce reliance on imported soybean meal, supports more sustainable feed systems, and can improve the biochemical composition of the final product. Well-balanced diets also enhance fatty acid profiles, oxidative stability, and shelf life meeting growing consumer interest in healthier, functional foods.

Genetics and farm management also influence key quality traits like texture and appearance. While genetic selection for rapid growth improves productivity, it must be balanced with animal welfare and muscle health to prevent conditions such as white striping and woody breast. At the same time, enriched environments and welfare-focused housing reduce stress, support animal health, and lead to better meat quality.

Post-mortem handling and processing techniques from slaughter to packaging have a direct impact on sensory properties and safety. Innovations such as electrical stimulation, vacuum packaging, and efficient cold chain management help preserve tenderness, juiciness, and microbiological integrity. These steps bridge production practices with the consumer's eating experience.

Looking ahead, sustainability and consumer trust will shape the future of the poultry industry. Reducing antibiotic use, finding value in by-products, and integrating renewable energy are all critical steps toward low-impact, ethical, and circular production systems. The long-term success of poultry meat depends not just on efficiency, but on balancing quality, animal welfare, and environmental responsibility.

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