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Quality Characteristics of Quil and Broiler Meat Stored Under Hot Climate Conditions

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Abstract. *This study aims to comparatively evaluate the meat quality characteristics of broiler (Ross-308) and quail (White English breed) raised under hot climatic conditions. With the increasing demand for animal-derived food products, the development of poultry production has become essential. Although broiler meat remains widely consumed, interest in quail meat has grown significantly in recent years due to its high nutritional value. In this study, quails were slaughtered at 42 days of age, while broiler chickens were slaughtered at 35 days. A comparative analysis of breast, thigh, and wing muscles was conducted. The scientific novelty of the research lies in the fact that, for the first time, a comprehensive and systematic comparative evaluation of these specific muscle groups in broiler and quail has been carried out. Moisture content was determined using a thermostat method, protein content by the Kjeldahl method, fat content by the Soxhlet extraction method, and ash content using a muffle furnace. Sensory evaluation of meat and broth samples was performed by a five-member panel using a 9-point scale. Meat freshness and pH values were also assessed. The results indicate that quail meat demonstrates superior quality indicators compared to broiler meat in terms of nutritional value. Moreover, quails exhibit greater resistance to temperature stress, making them more suitable for hot climates. These findings support the expansion of quail production as an economically viable and sustainable alternative.*

Keywords: *quil, White English breed, Ross 308, muscle, breast meat*

Introduction

In recent years, the demand for poultry meat in our republic has been steadily increasing. The population predominantly consumes broiler chicken meat. However, depending on the season, particularly during autumn and winter, the demand for turkey, goose, duck, and quail meat also rises (Taghiyev, 2023; Taghiyev, 2024).

As is well known, Azerbaijan encompasses 9 out of the 11 climatic zones observed worldwide. In the research regions studied, high temperatures during the summer months lead to the persistent occurrence of heat stress. These conditions negatively affect the quality of meat obtained from poultry. Other researchers (Kim & Lee, 2023, pp. 689–712) have also demonstrated that hot climatic conditions adversely influence both the clinical and physiological state of poultry and the productivity of meat obtained from them.

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One of the main factors negatively affecting the health of quail and broiler birds is heat stress. When temperatures rise excessively, the metabolic processes of birds are disrupted, and feed intake decreases. Under heat stress conditions, the respiratory process of birds is also impaired. As a result, blood pH levels increase, while CO_2 levels decrease. These changes lead to the development of respiratory alkalosis caused by hyperventilation.

Researchers indicate that quails are more resistant to heat stress compared to broiler chickens (Ribeiro et al., 2024, pp. 3–16). Quail meat is characterized by a high content of amino acids, particularly tryptophan, leucine, alanine, and methionine. In contrast, broiler chickens contain lower levels of unsaturated fatty acids. Quail meat is rich in polyunsaturated and monounsaturated fatty acids, especially linolenic and linoleic acids (Kokoszyński et al., 2024, pp. 2–4).

During heat stress, the level of lysozyme in the organism of birds decreases. In recent years, as in many other countries, interest in the consumption of quail meat has significantly increased in our republic. Researchers working in this field (Mammadova, 2024) note that, for meat production purposes, breeds such as White Texas, Pharaoh, as well as dual-purpose breeds including Manchurian, Estonian, and White English quails are raised both in Azerbaijan and in other countries.

However, due to the white color of the meat and the ability to produce up to 280 eggs per year, farmers and household producers most commonly prefer the White English breed (Abdilkhalikova, 2014).

The occurrence of various diseases among quails and broiler chickens raised under hot climatic conditions affects the quality of meat obtained from them in the future. In broiler production, the housing system has a direct impact on the pH values of the meat. It has been observed that the texture of meat obtained from birds raised in cage systems is of higher quality compared to that of birds raised in floor-based systems. However, in broiler chickens raised under cage systems, diseases such as leg fatigue are observed more frequently. The protein contained in broiler meat is essential for the human body. The housing system used in poultry production plays a crucial role in terms of both productivity and meat quality. Significant differences in meat quality are observed when broiler chickens are reared under different housing systems.

While quails raised in cage systems tend to have higher live body weight, the meat of birds raised on litter systems, despite having lower live weight, exhibits higher nutritional value due to its chemical composition (Wegner et al., 2024, pp. 5–8; Wang et al., 2021, pp. 2–8). Studies conducted in this field have shown that diseases affecting the reproductive organs in both quails and broiler chickens lead to a decrease in breast meat yield. Numerous researchers have demonstrated that when various feed additives are incorporated into the diet, quails exhibit better performance outcomes compared to broiler chickens. One of the important factors influencing the main characteristics of quail meat is the supplementation of feed with ginger powder and frankincense oil. These substances directly affect metabolic processes in the organism as well as the chemical composition of the meat. Their application contributes to enhancing the nutritional value of quail meat (Mohamed et al., 2024, pp. 4–5).

Methods

The research was conducted during 2024–2025 in the poultry housing facility located in the vivarium of the Azerbaijan State Agrarian University (ASAU), as well as under a shed during the summer months. The study was carried out on White English breed quails and Ross-308 broiler chickens, which are the most commonly reared and consumed poultry types in Azerbaijan.

During slaughter, the breast, thigh, and wing muscles of the quails were separated, and their weights and chemical characteristics were determined. Slaughtering of the quails was performed at 42 days

of age. In order to assess meat quality, five quails were slaughtered in each trial, and analyses were conducted on these samples. The same procedures were applied to Ross-308 broiler chickens; however, slaughter was carried out at 35 days of age.

During the study period, to determine the moisture content of the meat, the initial weight of the samples was first measured. Subsequently, the meat was kept in a thermostat for 20 minutes, after which it was reweighed, and the moisture content in the muscle tissue was calculated based on the difference. The protein content was determined using the Kjeldahl method, while the fat content was analyzed using the Soxhlet method (GOST, 2019).

The ash content of the meat was determined after incineration in a muffle furnace. The quality of quail meat under conditions of heat stress was studied both indoors and under a shed, considering birds reared in cage systems as well as on litter. In order to clarify the differences between quail and broiler meat, the same experimental conditions were also applied to Ross-308 broiler chickens.

The quality indicators of meat and broth obtained from quails and broiler chickens were determined at the Department of Hygiene and Food Safety of the Azerbaijan State Agrarian University (ASAU). A panel consisting of five staff members of the department was formed to conduct the sensory evaluation. The quality of the meat and broth was assessed using a 9-point scoring system.

The analysis of the chemical composition of quail and chicken meat was also carried out in the laboratory of the Livestock Scientific Research Institute (LSRI) on 25 April 2025 and was formalized under expert protocols No. 1080, 1081, and 1082.

For the evaluation of the economic efficiency of the obtained results and their statistical analysis, Microsoft Excel and SPSS 20 software packages were used. The level of statistical significance was considered at $P > 0.5$.

Results and Discussion

At the initial stage of the study, five quails from each group were slaughtered at 42 days of age in the ASAU vivarium, and their productivity indicators were determined. The results showed that the carcass weight of quails reared on the floor was 183 ± 2.02 g, whereas those kept in cages reached 186.6 ± 1.86 g. The breast muscle weight was 69.6 ± 0.16 g in floor-reared quails and 70.7 ± 0.58 g in cage-reared birds. Thigh muscle weights were 27.7 ± 0.84 g (floor) and 28.04 ± 0.73 g (cage), while wing muscle weights were 15.2 ± 0.04 g and 15.8 ± 0.01 g, respectively.

However, all indicators were higher in quails kept under a canopy, both in cages and on litter. The highest values were recorded in birds reared in cages under the canopy: breast muscle 86.5 ± 0.24 g, thigh muscle 31.4 ± 0.17 g, and wing muscle 16.4 ± 0.09 g. These findings indicate that cage rearing under a canopy leads to higher meat yield in quails. Chemical analysis of muscle tissues showed that samples obtained from cage-reared quails contained 72.03% moisture, 20.66% crude protein, 6.18% crude fat, and 1.13% crude ash (sample No. 1080; analyses conducted at the LRI laboratory).

Sensory evaluation revealed that breast meat from quails reared on the floor under a canopy received scores of 8 for aroma, 8 for taste, 7 for texture, and 7 for juiciness on a 9-point scale. In contrast, meat from cage-reared quails scored higher: 9 for aroma, 8 for taste, 9 for texture, and 9 for juiciness.

The broth prepared from quail meat obtained from cage-reared birds under a canopy was rated 9 for aroma, 8 for taste, 8 for consistency, and 9 for juiciness. For birds reared on the floor under a canopy, the corresponding scores were 8, 9, 9, and 6. Overall, both meat and broth from quails were considered highly suitable and valuable for human consumption regardless of rearing conditions. The chemical

composition of meat from Ross-308 broilers reared under a canopy was 71.6% moisture, 20.4% crude protein, 5.9% crude fat, and 2.1% crude ash. The fat content in broiler meat was lower than in quail meat by 0.28%.

An important aspect of meat quality is resistance to chemical reactions, as well as suitability for consumption and freshness. The results of freshness tests using copper sulfate and formalin reactions are presented in Table 1. The analyses showed that both quail and broiler meat gave negative results in the copper sulfate test, indicating no color change. The formalin reaction was also negative for both types, confirming their freshness and quality. However, when stored at room temperature for extended periods, changes in freshness were observed. In some cases, broiler meat showed positive reactions, whereas quail breast and thigh meat remained negative (Table 1).

The pH values of the meat were also determined: 6.7 in broilers and 6.9 i The pH values of the meat were also determined: 6.7 in broilers and 6.9 in quails; these values are critical as post-mortem pH decline is directly linked to chronic heat stress and the subsequent oxidative stability of the muscle tissue (Liu et al., 2022). According to Oluwagbenga & Fraley (2023), heat stress-induced glucocorticoid secretion can alter post-mortem glycolysis and pH decline, ultimately affecting meat quality parameters such as water-holding capacity and tenderness. In both types, pH decreased with longer storage time.

Table 1
Determination of freshness of quail and broiler meat (N = 5)

Indicators	Quail – White English (Cage)	Quail – White English (Floor)	Broiler – Ross 308 (Cage)	Broiler – Ross 308 (Floor)
Copper sulfate (12 h)	Negative	Negative	Negative	Negative
Copper sulfate (24 h)	Negative	Negative	Positive	Positive
Formalin (12 h)	Negative	Negative	Negative	Negative
Formalin (24 h)	Negative	Negative	Negative	Positive
Peroxidase reaction	Positive	Positive	Positive	Positive
pH	6.9	6.9	6.7	6.7

The results of the study demonstrated that quails reared in cages, particularly under a canopy, exhibited higher meat productivity and superior quality characteristics. Chemical analysis confirmed that quail meat contained higher levels of crude fat and protein compared to broiler meat, supporting its classification as a higher-quality product.

The comparison of pH values showed that quail meat (pH 6.9) has a less acidic environment than broiler meat (pH 6.7), which indicates better storage stability. Freshness tests further confirmed the superiority of quail meat: while broiler meat showed positive reactions after storage, quail meat remained negative. This indicates greater resistance to spoilage and higher biological quality. The observed differences in meat quality between quails and broilers may also reflect differential immune and physiological responses to heat stress; quails may exhibit greater resilience as evidenced by fewer changes in immune organ integrity and lower susceptibility to oxidative damage (Oluwagbenga & Fraley, 2023).

Overall, the higher fat content, more stable pH, and sustained negative freshness reactions demonstrate that quail meat is of higher quality, more resistant to storage conditions, and safer from a veterinary-sanitary perspective than broiler meat. For the first time, this study comparatively evaluated the physicochemical properties of muscle tissues in quail and broiler carcasses. The findings clearly indicate that, based on these parameters, quail meat is more suitable for human nutrition.

Conclusion

The findings confirm that under hot climate conditions, heat stress directly affects the physical and chemical properties of poultry meat, significantly influencing productivity and overall quality. In this context, quails demonstrate greater tolerance to heat stress compared to broiler chickens, whose physiological condition and productivity are negatively impacted under the same environmental conditions. The study shows that quail meat has superior physicochemical characteristics, including higher protein and fat content, as well as better sensory properties, making it more valuable for human nutrition. Freshness tests using copper sulfate and formalin indicate that both quail and broiler meat are initially fresh; however, during prolonged storage at room temperature, broiler meat exhibits signs of deterioration, whereas quail meat remains stable. The higher pH stability and resistance to spoilage observed in quail meat further confirm its better storage properties and higher biological quality. Overall, the comparative analysis demonstrates that quail meat is more resistant to heat stress, possesses higher quality indicators, and is more suitable for safe and nutritious human consumption than broiler meat.

Declaration of Competing Interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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