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NUTRITIONAL QUALITY OF POULTRY MEAT ACCORDING TO BREEDING SYSTEMS

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Abstract

The nutritional quality of poultry meat varies depending on the breeding systems used, influencing its composition in proteins, fats, vitamins, and minerals. Poultry meat is recognized as an affordable source of high-quality protein and other essential nutrients. Intensive, semi-intensive and extensive growth systems cause significant differences in nutrient composition. In intensive systems, meat chickens grow fast, having a higher fat content and a lipid profile dominated by saturated fatty acids. Extensive and semi-intensive systems, including outdoor access and diversified feeding, result in a healthier lipid composition with a higher polyunsaturated fatty acids, especially omega-3. In addition, poultry meat from extensive systems has a higher content of vitamins, such as vitamin E and minerals such as selenium, due to the more natural and diversified diet. Attributes such as low fat content and increased concentration of polyunsaturated fatty acids and antioxidants make the resulting products considered healthier and more ethical. In conclusion, the diversity of breeding systems offers opportunities to improve the nutritional quality of poultry meat, aligning it with consumer preferences and trends for healthy and sustainable products.

Key words*: breeding systems, fats, nutritional quality, poultry meat.*

INTRODUCTION

The quality of poultry meat is increasingly recognized as a crucial factor in consumer satisfaction and worldwide marketing. Key attributes that influence the quality of poultry meat include appearance, texture, nutritional value, and safety, each of which plays an essential role in consumer preferences and industry standards.

The appearance of poultry, characterized by the color of the skin and meat, is fundamental for consumer selection and satisfaction, affecting the presentation of meat both raw and cooked. Texture, mainly influenced by factors such as breed and processing techniques, remains a critical sensory attribute that defines the quality of consumption, with an emphasis on trend and succulence. Nutritional quality is another significant aspect, poultry meat provides essential proteins, vitamins, and minerals, beneficial to all types of consumers, regardless of age (Mir et al., 2017).

Safety and ethical production practices have become increasingly important in evaluating the quality of poultry meat, addressing issues such as animal welfare, environmental impact and health risks, such as antimicrobial resistance and disease transmission. The continuing challenges and advances in the field of breeding, nutrition, and processing aim to improve these quality attributes, aligning with global trends towards healthier food choices and ethical products (Iannetti et al., 2021).

Conventional poultry breeding systems are characterized by breeding chickens in enclosed spaces with limited access to natural factors such as sunlight and open space. These systems are more economically efficient but can lead to animal welfare problems and lower meat quality (Küçükyılmaz et al., 2012).

Alternative systems are characterized by the breeding of chickens in open spaces with unlimited access to natural factors. These systems are less economically efficient but give birds more space and a more varied diet, which can lead to better meat quality (Yan, 2017).

The outdoor breeding system is an alternative production strategy that can attract buyers from special markets for high-quality meat demand and is also a low-cost production system in suitable facilities for small-scale individual

breeding in developing countries (Li et al., 2017).

MATERIALS AND METHODS

This article aims to determine the variability of the nutritional composition between lots of broiler chickens in different technological breeding systems, comparing the lipid profile of chicken meat and the protein content.

For the phenotypic characterization of lots, classical statistical methods (Snedecor & Cochran, 1989) such as: average, variation, standard deviation, average error and variability coefficient were used. For the study of the homogeneity of the mediums, respectively for testing as statistically significant of the differences observed between the batches, the Student test was used (Fisher, 1992).

RESULTS AND DISCUSSIONS

Protein content of poultry meat

The intensive system has an average higher protein content in the chest (22.95 g vs. 22.78 g) compared with the extensive system (Table 1). The variability is relatively low between the two systems, indicating that the breeding methods slightly influence the protein composition of the meat, so the intensive breeding system has somewhat higher total protein content in the chest compared to the extensive system.

Table 1. The protein content of chest muscle tissue according to the growth systems of the chicks

Specification		U.M.	Intensive Growth Systems		Extensive Growth Systems	
			X	Sx	X	Sx
Breast protein	1	g	21.30	0.3862	21.76	0.1774
	2	g	23.03	0.3005	22.45	0.3031
	3	g	23.51	0.3966	23.59	0.6034
	4	g	23.67	0.6093	24.05	0.6245
	5	g	23.15	0.6631	22.66	0.3245
	6	g	22.45	0.2179	22.04	0.1279
	7	g	22.92	0.7688	22.86	0.7203
	8	g	23.66	0.2614	22.72	0.2597
	9	g	22.84	0.1244	22.88	0.3616
	Total	**g**	**22.95**	**0.4143**	**22.78**	**0.3892**

The variability within each system is low, and the differences between the systems are small and not statistically significant.

Table 2. Protein content of pulp muscle tissue according to chick growth systems

Specification		U.M.	Intensive Growth Systems		Extensive Growth Systems	
			X	Sx	X	Sx
Pulp Protein	1	g	19.10	0.5988	19.79	0.5443
	2	g	20.08	0.4550	18.67	0.2331
	3	g	20.11	0.7420	19.92	0.5029
	4	g	19.42	0.3553	20.63	0.8642
	5	g	18.85	0.2524	18.02	0.2222
	6	g	19.33	0.1429	19.41	0.8716
	7	g	19.54	0.6513	19.98	1.4158
	8	g	19.97	1.6196	19.35	0.6564
	9	g	20.81	0.8030	20.07	0.4605
	Total	**g**	**19.69**	**0.6245**	**19.54**	**0.6412**

The intensive system has an average higher protein content in the pulp (19.69 g vs. 19.54 g) compared with the extensive system (Table 2).

The differences between the intensive and extensive system averages for protein content in pulp are not statistically significant ($p>0.05$).

The protein content of poultry meat is similar in both breeding systems. However, poultry meat grown in alternative systems may have a higher biological value, which means that the human body can use the proteins in this meat more effectively.

The existence of two other specialized studies showed that poultry meat grown in organic farms had a higher content of proteins and essential amino acids, as well as a higher biological value. This means that the human body can more effectively use the proteins in poultry meat grown in organic farms (Ionescu et al., 2022; Yuan et al., 2022).

A study conducted by Jeni et al. (2021) showed that poultry meat grown in alternative systems may have a higher content of protein, essential amino acids and vitamins. However, there were no significant differences between the two growing systems in terms of mineral content.

The study carried out by Custură et al. (2024) demonstrated that feeding the Barred Plymouth Rock chickens with a low-energy diet, with specific concentrations of nutrients, did not have a negative impact on body weight, weight gain, carcass characteristics or the quality of proteins in the meat.

The findings suggest that slow-growing genotypes, Barred Plymouth Rock, can maintain growth performance and meat quality traits even when fed with low-protein and low-energy diets in an organic system (Custură et al., 2024).

Fat content

The extensive system has an average higher content of breast fat (1.41 g vs. 1.24 g) compared with intensive system (Table 3).

The variability is slightly higher in the extensive system, indicating a wider distribution of the fat content.

Table 3. The fat content of chest muscle tissue according to the growth systems of the chicks

Specification		U.M.	Intensive Growth Systems		Extensive Growth Systems	
			X	Sx	X	Sx
Breast Fat	1	g	1.16	0.1926	1.25	0.3585
	2	g	1.71	0.4761	1.33	0.4453
	3	g	1.83	0.4112	1.97	0.5602
	4	g	1.14	0.6142	0.73	0.2552
	5	g	0.49	0.2091	0.66	0.1579
	6	g	0.96	0.5611	1.93	0.4227
	7	g	1.01	0.3398	1.18	0.5152
	8	g	1.75	0.1089	2.29	0.3369
	9	g	1.11	0.4299	1.30	0.4042
	Total	**g**	**1.24**	**0.3714**	**1.41**	**0.3840**

The extensive growth system has a slightly higher total protein content in the chest than the intensive system, but the difference is not statistically significant.

Standard error values show that the estimated averages are relatively accurate, but the variability is higher in the extensive system.

The differences between the intensive and extensive system averages for fat content in pulp are not statistically significant ($p > 0.05$).

The extensive growth system has a slightly higher total fat content in the pulp compared to the intensive system (6.36 g vs. 6.03 g), but the difference is not statistically significant.

The variability is greater in the extensive system (1.4330 g) indicating a wider distribution of the fat content (Table 4).

A study by Socaciu et al. (2023) demonstrate that the fat content of poultry meat is lower in alternative systems than in conventional systems. This is because chickens raised in alternative systems have more physical activity, which leads to a reduction in fat storage.

Fortomaris et al. (2007) compares the impact of different breeding systems on the performance and well-being of chickens. The results showed that broiler chickens raised in alternative systems, such as the free-range system, have betters performance and well-being than conventional systems.

Table 4. The fat content of the muscle mass according to the growth systems of the chicks

Specification		U.M.	Intensive Growth Systems		Extensive Growth Systems	
			X	Sx	X	Sx
Fat pulp	1	g	5.95	1.2246	6.05	1.0396
	2	g	6.01	0.9147	6.37	0.7981
	3	g	6.61	0.6982	7.93	1.2892
	4	g	6.90	1.3987	5.09	1.8624
	5	g	6.77	0.6332	9.22	1.5524
	6	g	5.05	0.9000	5.08	0.4982
	7	g	5.57	0.4919	5.12	2.9781
	8	g	7.76	2.1487	7.18	0.9783
	9	g	3.59	2.2931	5.19	1.9005
	Total	**g**	**6.03**	**1.1892**	**6.36**	**1.4330**

The study results showed that broiler chickens bred in the extensive system performed better than those raised in the conventional system. They had higher body weight at slaughter, better food conversion and lower mortality (Fortomaris et al., 2007).

Aguiar et al. found that broilers raised in a conventional system had the highest lipid content, but lower proportions of polyunsaturated fatty acids and omega-3s compared to free-breeding and alternative chickens.

Free-breeding broilers had lower cholesterol content and a lower pH value compared to chickens raised in a conventional system (Jeni et al., 2021).

Another study by Gheorghe et al. highlighted the importance of dietary manipulation in improving the quality of meat by enriching the diets of animals with bioactive compounds such as PUFA, especially n-3 PUFA which have demonstrated health benefits in alleviating cardiovascular diseases, autoimmune diseases, and certain types of cancer.

Overall, the study recommended the use of ELP30 (a mixture of 30 percent flaxseeds and peas) in broiler diets to improve the nutritional value of meat for consumers, highlighting the

positive impact of PUFA-enriched dietary mixtures and probiotics on broiler health and meat quality (Gheorghe et al., 2022).
According to Pandurević et al. (2014) as regards consumer perception, they have shown that consumers consider free-breeding chicken meat to be healthier and tastier than poultry raised in intensive production systems, which makes their overall perception of outdoor production systems positive.

CONCLUSIONS

The study showed that different breeding systems significantly influence the nutritional quality of poultry meat.
Broiler meat grown in alternative systems, such as the free-range and extensive system, had a higher protein content, essential amino acids, and vitamins than conventional systems.
Broiler chickens raised in intensive systems show a higher fat content, with a higher proportion of saturated fatty acids than alternative systems. Instead, chickens raised in alternative systems have a healthier lipid profile with a higher concentration of polyunsaturated fatty acids and omega-3s, thereby reducing the risk of cardiovascular disease.
Studies have shown that alternative breeding systems, such as free-range, offer better chicken welfare and superior performance in terms of body weight, food conversion, and mortality, compared to conventional systems. Consumers also consider chickens bred in alternative systems to be healthier and tastier than those raised in intensive systems, with the overall perception of meat from outdoor production systems being positive.
The diversity of breeding systems offers opportunities to improve the nutritional quality of poultry meat, each system having own advantages and disadvantages.
The choice of the appropriate breeding system depends on the preferences of consumers and the producer's objectives in providing healthy and quality poultry meat.

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