

Research on the Assessment of Biochemical Parameters of Poultry Meat under an Identical Level of Energy and Protein

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Abstract

Biochemical parameters for poultry meat, in identical level of energy and protein, in terms of dry matter, raw fat content, and raw ash content were estimated in two poultry genetic types Cobb 500 and Ross 308. A total of 16 records, belonging to 60 individuals (male and female) which coming random from these two hybrids were analyzed. Chemical composition of meat was determined using standard methods: Standard ISO 1442/1997 for dry matter, Standard ISO 936/1998 for raw ash and Standard ISO 1443/2008 for lipids. There was a little variability in all analyzed traits. According to values of traits and t test, between two genetic types there are some statistically significant differences, under identical conditions of feeding and housing.

Keywords: biochemical parameters, hybrids, poultry meat quality.

1. Introduction

Meat quality has been defined by several authors as a combination of measurable characters (attributes, indices, criteria) which can be divided generally into four components: organoleptic, nutritional, technological and hygienic qualities [1].

From nutritional point of view, poultry meat is a valuable source of protein, also having a low fat content. From this point of view, the chemical composition of muscle tissue is the most important element of the quality of poultry meat [2-5].

Poultry meat quality is influenced by several factors, among which we can mention: genetic type, nutrition, growth conditions, health of the birds, loading and transport stress before slaughter etc.

Obtaining chicken with high quality of meat from nutritional point of view is essential for the development of the poultry sector in Romania. To

achieve this goal, chicken diet has an important role. Recipes fodder must provide an optimal level of energy and protein, plus amino acids, minerals, vitamins, etc. [6]. Values of biochemical parameters are influenced by recipes fodder administered to broilers in various stages of growth [6-8].

The work is part of a wider research that aims to optimize feeding schemes for obtaining biochemical and technological parameters of poultry meat in accordance with the quality standards in force. In this paper we study the influence of the genetic type on biochemical parameters of poultry meat under an identical level of energy and protein.

2. Materials and methods

Our research has been performed on individuals belonging to two genetic types of broiler chickens: Cobb 500 and Ross 308.

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Wishing to perform a balanced experiment, samples have equal size in observation units (chick) and equal ratio of sexes (male and female), and to eliminate the influence of other factors that can affect meat quality, individuals subject of the experiment were raised on permanent litter, in modern halls, with *ad libitum* food and water. The birds were slaughtered at the age of 42 days and then biochemical parameters of meat evaluated.

The research was conducted on a total of 60 chickens (i.e. 30 out of every genetic type), and at the end of the growing period, after slaughter randomized 16 carcasses (25%, 8 of each genetic type) were extracted and analyzed.

Feeding of chickens was done in accordance with the nutritional requirements of hybrids, adopting a feeding plan in three phases (Table 1).

Table 1. Mixed feed used in experiment

Nutritional characteristics	Starter (1-10 days)	Grower (11-25 days)	Finisher (26-42 days)
ME kcal/kg	3055	3178	3228
Crude protein %	24.00	22.00	20.00
Raw fat %	5.82	7.66	7.89
Raw ash %	3.63	3.75	3.90
Ca%	1.00	0.90	0.85
P %	0.50	0.45	0.42
Na%	0.16	0.16	0.16
Cl%	0.22	0.22	0.22
Lisyne %	1.44	1.25	1.05
Digestible lisyne for poultry %	1.32	1.13	0.94
Methionine %	0.96	0.85	0.71
Digestible methionine for poultry %	0.93	0.83	0.69
Methionine+Cystine%	1.36	1.22	1.04
Methionine+Cystine poultry%	1.27	1.13	0.96
Threonine %	0.93	0.82	0.75
Tryptophan %	0.26	0.25	0.23

Chemical composition of meat was determined using standard methods: Standard ISO 1442/1997 for dry matter, Standard ISO 936/1998 for raw ash and Standard ISO 1443/2008 for lipids. The raw data were processed using classical statistical methods [9].

3. Results and discussion

Dry matter of meat from the two genetic types was analyzed from pectoral muscles (breast) and leg muscles (thigh and drumstick).

We present in Table 2 the results on the dry matter content of breast meat in two studied genetic types.

Table 2. Dry matter of chicken breast

Genetic type	n	Mean \pm SEM(%)	s	v%
ROSS 308	8	27.66 \pm 0.27	0.7641	2.7625
COBB 500	8	26.84 \pm 0.31	0.8773	3.2686
t = 2.0258 ^{NS}				
Differences significance $t_{14;0.05} = 2.145$; $t_{14;0.01} = 2.977$; $t_{14;0.001} = 4.140$				

It is noted that, in terms of average content of dry matter in the meat of the breast, the values recorded in the two genetic types are similar, with a low variability of observations and close, the calculated value of the coefficient of variability indicating uniform conditions of feeding and housing.

It is noted that, in the case of ROSS 308 hybrid, the average dry matter content of the breast meat

was 27.66% \pm 0.27, whereas in the case of Cobb 500 hybrid, the value was slightly lower, respectively 26.84 % \pm 0.31. Higher dry matter content recorded at Ross 308 chickens do not necessarily represent their superiority because the observed differences are not statistically sustained and calculated value of the Student test supporting this statement ($t = 2.0258^{\text{NS}}$). Thus, if an identical level of energy and protein in the recipe, there are

not significant differences between the two genetic types; different values recorded were attributed to possibly errors in the sample. Basically, the two hybrids have the same values in the dry matter of breast meat.

The values of dry matter content of the pulp meat (thigh and shank) to the two studied genetic types are presented in Table 3.

Table 3. Dry matter of chicken legs

Genetic type	n	Mean \pm SEM(%)	s	v%
ROSS 308	8	28.54 \pm 0.21	0.5943	2.0823
COBB 500	8	27.84 \pm 0.26	0.7358	2.6430
Differences significance		t = 0.7641 ^{NS} t _{14;0.05} = 2.145; t _{14;0.01} = 2.977; t _{14;0.001} = 4.140		

It may be noted the existence of close values of dry matter content of the pulp meat that being analyzed at the two hybrids. As with the meat of the pectoral muscles, there is a higher value of the parameter recorded for samples from Ross 308 individuals (28.54% \pm 0.21) by approximately 2.5% compared to samples taken from Cobb 500 individuals (27.84% \pm 0.26).

Observations variability was low, below 2% for samples from both genetic types and the differences between means has no statistical significance, the calculated value of the Student test was below the critical value (t = 0,7641^{NS}). Therefore, the two hybrids can be considered equal in terms of dry matter content of the meat

from the breast and thighs. In other words, when energy and protein content in the recipe remains identical during growth period and technology is respected, the values of the two hybrids, in the same environmental conditions, are close.

The fat content of the meat is an extremely important parameter that directly influences the nutritional qualities, organoleptic (juiciness, tenderness, flavour) and processing suitability in different preparations. In terms of fat content, poultry meat is a source of healthy food, safe, nutritious and affordable in economic terms.

Table 4 shows the results of the raw fat content of meat from the pectoral muscles at the two genetic types.

Table 4. Raw fat of chicken breast

Genetic type	n	Mean \pm SEM(%)	s	v%
ROSS 308	8	4.79 \pm 0.11	0.3113	6.4990
COBB 500	8	4.66 \pm 0.16	0.4528	9.7167
Differences significance		t = 1.0024 ^{NS} t _{14;0.05} = 2.145; t _{14;0.01} = 2.977; t _{14;0.001} = 4.140		

Analyzing the data presented in Table 4 is observed that crude fat content of breast meat derived from two hybrids is very close at the two genetic types. Heterogeneity of observations is low, as evidenced by the coefficient of variation.

For samples belonging Ross 308, the average content of crude fat was 4.79% \pm 0.11, and about this parameter of Cobb 500 individuals, it was lower (4.66% \pm 0.16). The difference observed between average is statistically non-significant (t = 1.0024^{NS}) and thus the two hybrids behave the same under the conditions of the experimental set. Crude fat content values in the legs (thigh and shank) from the two hybrids are shown in Table 5. The data presented in Table 5 reveals the

existence of apparently similar values of crude fat content of the pulp meat from the two hybrids.

The data presented reveal the superiority of the analyzed parameter in Cobb 500 (8.66% \pm 0.12), crude fat being higher by about 4.7% than in the case of samples taken from Ross 308 (8.27 % \pm 0.07). These differences are statistically tested and calculated value of the Student test (t = 2.1527*) indicating significant differences between the two hybrids in conditions of homogenous data. Thus there was a slight superiority Cobb 500 hybrid that seems, at least in the experimental conditions of this work, would make better use of feed energy, depositing a greater amount of fat in the thighs.

Table 5. Raw fat of chicken legs

Genetic type	n	Mean \pm SEM(%)	s	v%
ROSS 308	8	8.27 \pm 0.07	0.1981	2.3954
COBB 500	8	8.66 \pm 0.12	0.3396	3.9215
Differences significance		t = 2.1527* t _{14;0.05} = 2.145; t _{14;0.01} = 2.977; t _{14;0.001} = 4.140		

Nutritional quality of meat is given also by mineral content and thus crude ash content is an important indicator of it.

Table 6 present the results on the crude ash content of meat from the chest at the two genetic types.

Table 6. Raw ash of chicken breast

Genetic type	n	Mean \pm SEM(%)	s	v%
ROSS 308	8	1.16 \pm 0.03	0.0849	7.3190
COBB 500	8	1.11 \pm 0.01	0.0283	2.5495
Differences significance		t = 0.6628 ^{NS} t _{14;0.05} = 2.145; t _{14;0.01} = 2.977; t _{14;0.001} = 4.140		

The data presented in Table 6 show that the amount of mineral content (raw ash) is close to the samples analyzed from two general types. Value of variation coefficients for the two situations is low, indicating homogeneity of data.

Thus, at Ross 308 individuals average content of raw ash from pectoral muscle was 1.16% \pm 0.03, with 4.5% higher than the value of this parameter recorded in samples from Cobb 500 individuals (1.11% \pm 0.01). Testing the significance of

differences observed between the two averages pointed out that this superiority is not sustained from statistically point of view, which means that respecting growing technology in terms of nutrition, the two hybrids have the same quality of meat from pectoral muscles.

Regarding raw ash content in pulp meat, values of this parameter in the two hybrids are presented in Table 7.

Table 7. Raw ash of chicken legs

Genetic type	n	Mean \pm SEM(%)	s	v%
ROSS 308	8	1.02 \pm 0.01	0.0283	2.7745
COBB 500	8	0.97 \pm 0.009	0.0255	2.6289
Differences significance		t = 2.1468* t _{14;0.05} = 2.145; t _{14;0.01} = 2.977; t _{14;0.001} = 4.140		

Analyzing the data presented in Table 7 can be highlighted lower values of raw ash compared to breast meat, due to a higher fat content, and minerals content different from the two hybrids. Thus, the results reveal higher values by approximately 5% of raw ash from Ross 308 individuals (1.02% \pm 0.01) compared with the parameter registered at Cobb 500 hybrid (0.97% \pm 0.009). The calculated value of the Student test (t = 2.1468*) indicates that there are statistically significant differences between the two hybrids, under identical conditions of feeding and housing. Poultry meat attributes can be affected by a number of factors that impact on muscle metabolism and chemical composition. The research results of the biochemical parameters of meat vary from one author to another. The interaction of these factors can cause

heterogeneity of these results. Thus, for example, Zollitish et al (1997) states that there are no significant differences in water content between breast meat and thigh meat [10], and Fujimura et al (1996) suggest that the dry matter content varies significantly depending on the genetic type [11]. Fanatico et al (2005) found that there are no significant differences between different genetic types in terms of dry matter, ash and crude fat [12], but Meluzzi et al (2009) states that poultry meat quality is directly related to genetic type [13].

4. Conclusions

Regarding the dry matter content, when energy and protein content in the recipe remains identical

during growth, the values of the two hybrids in the same environmental conditions are close.

It is observed a higher fat content in the thigh meat from Cobb 500 hybrid which seems, at least in the experimental conditions of this work, would make better use of feed energy.

It has revealed a higher content of minerals in pulp meat coming from the Ross 308 hybrid, with nearly 5%, under identical conditions of feeding and housing.

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