# The Influence of the Feed Protein and Energy Level on the Meat Chemical Composition at „Lohmann Meat" Hybrid

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**Abstract**
In this paper was studied the influence of feed energy-protein level on meat chemical composition depending on sex and anatomical region for chicken broiler belonging „LOHMANN MEAT" hybrid, slaughtered at 42 days old. The two groups (control group-Lc and experimental groups-Lexp.) were given feed mixed with different level of energy and protein (Lc-standard hybrid, Lexp.-higher by 10% compared to standard hybrid). After slaughter, from each group were sampled 10 carcasses (five females and five males), and from different portions of the carcass (breast, thighs and shanks), was determined the meat chemical composition (water, dry matter, protein, lipids and minerals) using STAS methods. For males the pectoral muscle had a greater amount of dry matter, compared with females, the situation is reversed when has been referring to the muscles of the thighs and shanks. The proteins content in meat has presented variation depending on: sex (in males was registred big values comparative with females), anatomical region (in pectorals was registred maximum values and in thighs minimum values) and nutrition (feed with energy and protein high level was determined incresed content the protein in meat). The lipids content in meat showed the biggest variation between muscles analyzed, with minimum values in the pectoral muscles (from 0.67 at males-Lexp. to 0,95% in females-Lc) and maximum values in the upper thigh muscles (from 6.97% in males-Lexp. to 8,23% in females-Lc). The high quality value on meat has been at the Lexp. group, which in all cases had the highest protein content and lowest lipids content in muscles.

**Key words**: *chemical composition, dry matter, lipids, minerals, proteins*

## 1. Introduction

The problem on protein nutrition and especially the current shortcomings in providing for the body with proteins is one of the most current problems for human nutrition [1].
Meat is a commodity product obtained from animals and poultry meat represent one of the very important foods for humans nutrition, because has an energetic and plastic role [2, 3].
Obtaining of broiler chicken with high quality carcasses, the commercial aspect of the carcass and a competitive price are the essential conditions for development of the poultry meat production in Romania. Also, the demand of Romanian consumers for the poultry meat quality and for the quality of poultry products has increased greatly in lately.
Broiler chickens have specific nutritional requirements to achieve performance criteria proposed. Thus, the foods rations have to ensure an optimal level of energy, protein, amino acids, minerals, vitamins and essential fatty acids [4, 5].
Only an adequate feeding program can ensure maximum expression of genetic potential and achieving top quality carcasses [5, 6, 7].A carcass of superior quality is characterized by a maximum proportion of meat, and a minimum proportion of fat and bone. The chemical composition of meat is

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greatly influenced by the feed rations used at broiler [1, 5, 6, 8, 9, 10, 11, 12]. The meat obtained from broilers specialized in this area is known for its qualities: sensory, technological, physical, chemical, nutritional and dietary [1, 6, 11,13].Since research on improving the performance of growing for broiler chickens carried both in our country and abroad includes in particular the quantitative aspects of meat production on this category of poultry, in this paper was studied the influence of the feed energy and protein level on the meat chemical composition from different anatomical regions at broilers belonging to the „LOHMANN MEAT" hybrid sacrificed at the age of 42 days.

## 2. Materials and methods

Our research was made on broiler chicken obtained from „LOHMANN MEAT" hybrid, sacrificed at the age of 42 days. In this study, we had two groups of chicks (males and females in equal ratio), control group (Lc) and experimental group (Lexp.), reared in the same microclimate condition.

At the two groups of chickens was given feed mixed with protein and energy levels differently as follows: Lc-protein and energy level was conform with recommenda company Aviagen for the „LOHMANN MEAT" hybrid [7]; Lexp.-protein and energy level with 10% higher than company Aviagen recommendation for „LOHMANN MEAT" hybrid. Depending on the age of chicks during growth (1-42 days) for each group were given three fodder recipes (starter, growing and finishing) (table 1) [1, 6, 7].

**Table 1**.Features of the mixed feed recipes for chickens

| Recipe features | Chicken group | |
|---|---|---|
| | Lc | Lexp. |
| Starter 1-14 days | | |
| Crude protein (%) | 24.02 | 26.23 |
| M. E. (kcal/kg feed) | 3041 | 3270 |
| Energy : Protein ratio | 126.60 | 124.7 |
| Grower 15-35 days | | |
| Crude protein (%) | 22.63 | 24.90 |
| M. E. (kcal/kg feed) | 3144 | 3435 |
| Energy : Protein ratio | 133.00 | 137.95 |
| Finisher 36-42 days | | |
| Crude protein (%) | 21.06 | 23.12 |
| M. E. (kcal/kg feed) | 3190 | 3490 |
| Energy : Protein ratio | 151.50 | 150.00 |

After the slaughter, from each group were sampled 10 carcasses (five females and five males), from different anatomical regions (breast, thighs and shanks) was determined the chemical composition of meat (water, dry matter, protein, lipids and minerals). Methods of analysis used to determine the chemical composition of the meat were: drying oven for determination of water and dry matter (Standard ISO 1442/1997); calcinations method for determination of minerals (Standard ISO 936/1998); Soxhlet method on modern appliances-Soxtest Raypa PG-16 E01 to determine the amount of lipids (Standard ISO 1443/2008); Kjeldahl method to determine protein substances (Standard ISO 937/2007) adapted for appliances type FOSS TECATOR [14, 15, 16].

Raw data obtained from measurements were processing using methods of biostatistics with Microsoft Excel spreadsheet application. To test the statistical significance of differences between mean values of the characters studied has been applied analysis of variance using Mann Whitney test from the program MINITAB 14 [17].

## 3. Results and discussion

Average results on the chemical composition of meat in the pectoral muscles are shown in table 2.

The data from table 2 shows that, in the breast meat the water content has were between 72.69 to 73.03% at males and between 73.23 to 74.11% at females. Only for the males, the test analysis of variance showed the presence of differences statistically significant.

For the pectorals muscles in the samples taken at males, the water quantity was lower and the dry matter content was greater, compared with females where the situation is reversed [10,11,18].

At control group, for pectorals muscles the water content was greater as compared with Lexp. group (73.03% vs. 72.69% in males and 74.11% vs. 73.23% in females) and for dry matter content the situation is reversed (26.97% vs. 27.37% in males and 25.89% vs. 26.77% in females) .

Lipids content in pectorals muscle, had values ranging from 0.67 to 0.84% in males and from 0.80 to 0.95% in females, variance analysis revealed the presence of statistical differences ($p \leq 0.05$). (table 2)

In Lexp. group, the breast muscle was characterized by lower lipids content (from 0.67 up to 0.80%) and higher protein content (from

**Table 2.**The chemical composition of meat from the pectoral muscles

| Specification | Males-Lc | | Females-Lc | | Males-Lexp | | Females-Lexp. | |
|---|---|---|---|---|---|---|---|---|
| | $\bar{x} \pm s_{\bar{x}}$ | CV% | $\bar{x} \pm s_{\bar{x}}$ | CV% | $\bar{x} \pm s_{\bar{x}}$ | CV% | $\bar{x} \pm s_{\bar{x}}$ | CV% |
| Water (%) | 73.03$^{a}$ ±0.18 | 0.55 | 74.11 ±0.40 | 1.23 | 72.69$^{b}$ ±0.12 | 0.37 | 73.23 ±0.20 | 0.62 |
| Dry matter $\bar{x} \pm s_{\bar{x}}$ (%) | 26.97 ±0.17 | 1.49 | 25.89 ±0.38 | 3.50 | 27.31 ±0.14 | 0.97 | 26.77 ±0.25 | 1.67 |
| Proteins $\bar{x} \pm s_{\bar{x}}$ (%) | 24.33$^{a}$ ±0.17 | 1.58 | 23.20$^{ab}$ ±0.37 | 3.55 | 25.17$^{ab}$ ±0.14 | 1.26 | 24.40$^{a}$ ±0.25 | 2.28 |
| Lipids $\bar{x} \pm s_{\bar{x}}$ (%) | 0.84$^{a}$ ±0.03 | 7.85 | 0.95$^{ab}$ ±0.03 | 7.63 | 0.67$^{ab}$ ±0.03 | 8.51 | 0.80$^{b}$ ±0.03 | 9.34 |
| Minerals $\bar{x} \pm s_{\bar{x}}$ (%) | 1.08 ±0.04 | 7.99 | 1.11 ±0.05 | 9.43 | 1.11 ±0.04 | 8.29 | 1.17 ±0.06 | 12.41 |

MANN WHITNEY test-between groups: $^{ab}$significant differences $p \leq 0.05$

25.17 up to 24.40%) compared with the control group which has had higher lipids contents (from 0.84 up to 0.95%) and lower protein content (from 24.33 up to 23.20%).

In pectorals muscles the protein content ranged between 24.33 to 25.17% in males and from 23.20 to 24.40% in females. Thus, at Lexp group the average values obtained for protein content were higher , as compared with control group (25.17% vs. 24.33% in males and 24.40% vs. 23.20% in females). The values obtained in this study are situated to the higher limit specified in the literature for this type of meat [3, 18, 19, 20, 21]

At Lexp. group, for the chemical composition of the pectorals muscles were recorded the lowest values for water content and lipids and the higher values for dry matter content and proteins, as compared with the control group (Lc).

In table 3 it's presented the chemical composition of meat for the samples taken from thighs area.

In muscles from thighs area, the water content has ranged from 72.17 to 72.79, with higher values for males compared with the females (72.79% vs. 72.54% at Lc and 72.54% vs. 72.17% at Lexp.). Thus, for samples taken from experimental group (Lexp.), water content was from 72.17% (in females) up to 72.54% (in males) and at control group (Lc) from 72.49% (in females) up to 72.79% (in males).

In thighs muscles the dry matter content was higher in case samples taken from females compared with males and for control group (Lc) compared with experimental group (Lexp.).

For proteins in the thigh meat was found values from 18.02 up to 18.20% at control group (Lc) and from 19.02 up to 19.12% at experimental group (Lexp.). Thus, for samples taken from males averages values for protein content were higher compared with females (18.20% vs. 18.12% at Lc group and 19.12% vs. 19.02% at Lexp. group).

**Table 3.**The chemical composition of meat from the thighs muscles

| Specification | Males-Lc | | Females-Lc | | Males-Lexp | | Females-Lexp. | |
|---|---|---|---|---|---|---|---|---|
| | $\bar{x} \pm s_{\bar{x}}$ | CV% | $\bar{x} \pm s_{\bar{x}}$ | CV% | $\bar{x} \pm s_{\bar{x}}$ | CV% | $\bar{x} \pm s_{\bar{x}}$ | CV% |
| Water (%) | 72.79 ±0.59 | 1,82 | 72.49 ±0.73 | 2.25 | 72.54 ±0.61 | 1.87 | 72.17 ±0.61 | 1.87 |
| Dry matter $\bar{x} \pm s_{\bar{x}}$ (%) | 27.21 ±0.59 | 4.87 | 27.51 ±0.73 | 5.92 | 27.46 ±0.61 | 4.95 | 27.83 ±0.88 | 7.05 |
| Proteins $\bar{x} \pm s_{\bar{x}}$ (%) | 18.20 ±0.63 | 7.69 | 18.02 ±0.62 | 7.74 | 19.12 ±0.74 | 8.71 | 19.02 ±0.80 | 9.41 |
| Lipids $\bar{x} \pm s_{\bar{x}}$ (%) | 7.63$^{a}$ ±0.14 | 4.11 | 8.23$^{ab}$ ±0.20 | 5.45 | 6.97$^{ab}$ ±0.22 | 6.92 | 7.54$^{b}$ ±0.14 | 4.06 |
| Minerals $\bar{x} \pm s_{\bar{x}}$ (%) | 0.97 ±0.02 | 3.53 | 0.95 ±0.02 | 4.58 | 1.01 ±0.02 | 5.10 | 0.98 ±0.03 | 7.67 |

MANN WHITNEY test-between groups: $^{ab}$significant differences $p \leq 0.05$

The variation coefficient no exceeding the value of 9.5% and revealed very good homogeneity.

Analysis of variance no revealed statistical differences between averages values obtained at

males compared with females and between the control group compared with the experimental group.
The lipids proportion in thighs muscles was higher at control group (7.63% at males and 8.23% at females), compared with the experimental group (6.97% at males and 7.54% at females). The test for analysis of variance revealed statistical differences ($p \leq 0.05$) between averages values obtained at males compared with females and between control group vs. experimental group.
Data related to water content, dry matter, proteins, lipids and minerals in the samples taken from shanks are presented in table 4.
Water proportion in shanks muscles was higher at males compared with females (72.07% vs. 71.17% at Lc group and 72.56% vs. 71.17% at Lexp. group). Thus, for the dry matter proportion from shanks muscles situation is reversed. The differences between compared means (water and dry matter) did not reveal statistical significance in any considered situation.
However, meat taken from shanks at experimental group (Lexp.) was richer in protein (from +6.47% in females up to +7.05% in males) and poor in lipids (from -17.73% in females up to -27.97 in males), compared to the control group (Lc). Thus, in shanks muscles samples taken from males the lipids content was lower (-11.13% at control group up to -26.93% at Lexp. group), as compared with females.

**Table 4.**The chemical composition of meat from the shanks muscles

| Specification | Males-Lc | | Females-Lc | | Males-Lexp | | Females-Lexp. | |
|---|---|---|---|---|---|---|---|---|
| | $\bar{x} \pm s\bar{x}$ | CV% | $\bar{x} \pm s\bar{x}$ | CV% | $\bar{x} \pm s\bar{x}$ | CV% | $\bar{x} \pm s\bar{x}$ | CV% |
| Water (%) | 72.07 ±0.70 | 2.17 | 71.17 ±0.79 | 2.50 | 72.56 ±0.82 | 2.53 | 71.17 ±0.96 | 3.02 |
| Dry matter (%) | 27.93 ±0.70 | 5.60 | 28.83 ±0.79 | 6.16 | 27.44 ±0.82 | 6.69 | 28.83 ±0.96 | 7.47 |
| Proteins (%) | 19,85 ±0.70 | 7.89 | 20.08 ±0.72 | 8.00 | 21.25 ±0.58 | 6.10 | 21.38 ±0.76 | 7.97 |
| Lipids (%) | $6.65^{a}$ ±0.14 | 4.85 | $7.39^{ab}$ ±0.17 | 5.00 | $4.79^{ab}$ ±0.39 | 18.38 | $6.08^{b}$ ±0.42 | 15.30 |
| Minerals (%) | 1.02 ±0.04 | 8.29 | 1.04 ±0.05 | 9.76 | 1.04 ±0.02 | 3.56 | 1.08 ±0.05 | 10.11 |

MANN WHITNEY test-between groups: $^{ab}$significant differences $p \leq 0.05$

Chemical analysis (water, dry matter, proteins and lipids) from breast fillet, shanks and thighs revealed differences between values obtained at males compared with females and between values obtained at experimental group (Lexp.) compared with control group (Lc) [10, 11].
The protein proportion in the breast fillet have higher values (from 23.20 up to 25.17%), compared with the shanks and thighs (from 20.28 up to 21.38% in shanks and from 18.02 up to 19.12% in thighs). Thus, were observed the following differences: between the breast and shanks from 3.02 up to 4.48% ; between the breast and thighs from 5.18 up to 6.13% and between the shanks and thighs from 1.65 up to 2.36%.
The lipids content, in breast fillet was up to 0.95%, for thighs muscles from 6.97 up to 8.23% and for shanks muscles from 4.79 up to 7.39%. Thus, were calculated the following differences: between shank muscles and breast of 3.02 up to 4.48%; for thighs muscles differences vs. breast were of 5.18 up to 6.13% and between thighs and shanks of 0.84 up to 2.12%.
The results which were obtained in this study, for the chemical composition of meat from breast fillet, thighs and shanks from broiler chickens sacrificed at the age 42 days, are consistent with the values mentioned in the scientific literature for these meats [2, 18, 19, 20, 21].

## 4. Conclusions

In breast fillet the water proportion, proteins and minerals was higher, as compared with shanks and thighs muscles, which have higher dry matter proportion and lipids.

The feed with energy and protein higher level were responsible for the increased the protein content of and reducing lipids content in the breast fillet, shanks and thighs muscles.

For samples taken from females was higher of lipids proportion, as compared with males, in any considered situation.

Lipids of the meat had the biggest variation between muscles analyzed, in the pectoral muscles were recorded minimum values (0.67 to 0.95%), and in the thighs were maximum values (up to 8.23%).

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