Comparative analysis of the chemical composition of turkey meat of different breed groups in the conditions of the South Urals

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Abstract. Turkey meat is one of the most valuable poultry products. The purpose of the study is to compare the chemical composition of meat of turkeys of different crosses in the conditions of the South Urals. For the experiment, four groups of turkey poults were chosen: medium cross Broad Breasted White; heavy cross Broad Breasted White; medium cross Hybrid Converter; heavy cross Hybrid Converter. It was found that the cross Hybrid turkey meat is qualitatively superior to the meat of turkeys of different Broad Breasted White crosses in terms of protein content in red and white meat, as well as in the lower fat content. The energy value of Broad Breasted White turkey meat was found to be insignificantly higher due to different fat content, except for the energy value of white meat from medium cross turkeys.

1. Introduction

The meat of farm animals and poultry, including turkeys, is one of the sources of nutrients that humans need; therefore, the quality characteristics of this nutrient source is to be improved [1, 2]. Advanced technology solutions to processing products of animal origin are of primary importance in food production [3–7]. Meat products and products of animal origin are supposed to meet current food safety requirements and consumer expectations [8–13].

The term ‘qualitative characteristics of meat’ typically implies a combination of organoleptic and biological indicators, which affect practical suitability of meat to meet human needs for various nutrients [14, 15]. The most common concept used to characterize the meat quality is its energy value.
The energy and biological value of turkey meat is primarily characterized by the total amount and ratio of proteins, fats and vitamins. The way they are assimilated is also relevant. In addition, organoleptic indicators and energy value of meat are important [16–19].

The chemical composition of meat is one of the objective indicators of its energy value, and, hence, of its qualitative characteristics [20, 21].

Meat is divided into white and red, which is associated with the color of muscle fiber. Pectoral muscles are primarily white meat, and thigh muscles are red meat. In addition, meat color depends on the amount of protein and myoglobin that gives meat its color. White meat contains a higher amount of high-grade protein, carnosine and glycogen compared to red meat, but less fat and vitamin C. The texture of white meat is more delicate due to thinner muscles compared to those in red meat, and lower content of connective tissue. To make the picture complete, the characteristics of white and red turkey meat should be studied both individually and taken together.

2. Materials and methods
For the experiment, 4 groups of turkey poults (males) were selected at a daily age of 30 animals each. Group 1 – middle cross Broad Breasted White turkeys; group 2 – heavy cross Broad Breasted White turkeys; 3 group – medium cross Hybrid Grade Maker; group 4 – heavy cross Hybrid Converter. Medium crosses were grown up to 120 days of age, and heavy crosses were up to 150 days of age.

Meat was evaluated for 5 turkeys from each group, aged 120 and 150 days, of medium and heavy crosses, respectively.

The moisture content was estimated by drying at a constant temperature of 100–105 °C.

The mass fraction of protein was determined by the Kjeldahl method.

The mass fraction of fat was found using the Soxhlet method.

The ash content in meat was found by burning in a muffle furnace at 600–800 °C.

The energy value of meat and meat products was determined by calculating the content of fat, protein and carbohydrates per 100 g of product.

3. Results and discussion
Table 1 presents data on the results of study of the chemical composition of white meat in experimental turkeys.

The data obtained show that white meat of turkeys from groups III and IV contains more protein than white meat of turkeys from groups I and II by 0.9% in both cases. Meat of turkeys from groups I and II was higher in fat compared to meat of turkeys from groups III and IV by 0.2% (P ≤ 0.05) and 0.6% (P ≤ 0.05), respectively. Similarly, the moisture content in meat of turkeys from groups I and II was higher than that in meat of turkeys from groups III and IV by 0.6 and 0.2%, respectively. The ash content in meat of turkeys from groups I and II was insignificantly higher compared to that in meat of turkeys from groups III and IV by 0.1% (P ≤ 0.05) in both cases.

| Indicators | Group I | Group II | Group III | Group IV |
|------------|---------|----------|-----------|----------|
| Water, %   | 77.4±0.72 | 74.3±0.34 | 76.8±0.56 | 74.1±0.38 |
| Protein, % | 18.9±0.33 | 21.5±0.72 | 19.8±0.14<sup>a</sup> | 22.4±0.33<sup>a</sup> |
| Lipids, %  | 2.5±0.07  | 3.0±0.02  | 2.3±0.01<sup>a</sup> | 2.4±0.01<sup>a</sup> |
| Ash, %     | 1.2±0.01  | 1.2±0.01  | 1.1±0.01<sup>a</sup> | 1.1±0.02<sup>a</sup> |
The energy value was found to be higher in meat of heavy cross turkeys from groups II and IV compared to that in meat of medium cross turkeys. Among medium cross turkeys, meat of turkeys from group III was superior to that of turkeys from other groups in the energy value by 1.9 kcal, and among heavy cross turkeys, the energy value of meat of turkeys from group II exceeded that in meat of turkeys from other groups by 2.3 kcal. An insignificant difference in the energy value indicates that turkey meat is high in calories regardless of the cross and exhibits energy value varying from 100.7 to 116.5 kcal.

Table 2 presents the results of study of the chemical composition of red meat.

### Table 2. The chemical composition of red meat.

| Indicators       | Group  |
|------------------|--------|
|                  | I      | II     | III    | IV     |
| Water, %         | 77.0±0.13 | 75.1±0.54 | 75.8±0.17<sup>a</sup> | 73.6±0.26<sup>a</sup> |
| Protein, %       | 18.6±0.01 | 20.2±0.05 | 20.4±0.03<sup>b</sup> | 22.8±0.02<sup>b</sup> |
| Lipids, %        | 3.5±0.07  | 3.7±0.02  | 2.6±0.01<sup>b</sup> | 2.4±0.01<sup>b</sup> |
| Ash, %           | 1.1±0.03  | 1.0±0.01  | 1.2±0.01<sup>a</sup> | 1.1±0.02<sup>a</sup> |
| Energy value, kcal | 108.8  | 122.2 | 107.8 | 115.8 |

Table 2 shows that the protein content in red meat of turkeys from groups III and IV is higher than that in red meat of turkeys from groups I and II by 1.8 and 2.6% (P ≤ 0.01), respectively. The fat content was observed to be higher in meat of turkeys from groups I and II compared to that in meat of turkeys from groups III and IV by 0.9 and 1.3% (P ≤ 0.01), respectively. The moisture content was higher in meat of turkeys from groups I and II than that in meat of turkeys from groups III and IV by 1.2 and 1.5% (P ≤ 0.05), respectively. Meat of turkeys from groups I and II was insignificantly higher in ash compared to that in meat of turkeys from groups III and IV by 0.1% (P ≤ 0.05) in both cases.

The energy value of red meat was higher in turkeys of heavy crosses from groups II and IV compared to that of meat from turkeys of medium crosses. The energy value was higher in meat of Broad Breasted White turkeys from groups I and II and exceeded that in meat of Hybrid turkeys from groups III and IV by 1.0 and 6.4 kcal, respectively, which is due to higher fat content in meat of Broad Breasted White turkeys. Turkey meat is high in calories regardless of the cross and exhibits energy value varying from 107.8 to 122.2 kcal.

In addition, we analyzed the chemical composition of the average sample of meat from turkey poults. The data obtained are presented in table 3.

### Table 3. The chemical composition of the average sample of turkey meat.

| Indicators | Group |
|------------|-------|
|            | I     | II    | III   | IV    |
| Water, %   | 77.0±0.13 | 74.5±0.12 | 76.3±0.17 | 73.8±0.16<sup>a</sup> |
The analysis of the average sample of turkey meat confirms the results of study of white and red meat. The average sample of Hybrid cross turkey meat contains more protein and less fat than the average sample of meat from Broad Breasted White turkeys of similar crosses. The dry substance content increases and the moisture content decreases with age. The meat samples of heavy cross turkeys show the highest energy value and the lowest ash content.

4. Conclusion

Thus, the comparison of medium and heavy crosses of Hybrid and Broad Breasted White turkeys has shown that Hybrid cross turkey meat is superior to Broad Breasted White turkey meat in qualitative characteristics. It can be concluded that Hybrid cross turkey meat contains more protein and less fat. Due to the different fat content, the energy value of Broad Breasted White turkey meat was observed to be insignificantly higher, except for indicators of white meat from medium cross turkeys.

The analysis of the average sample of turkey meat confirms the findings concerning the chemical composition of white and red meat and shows that the average sample of Hybrid cross turkey meat is higher in protein and lower in fat. The dry substance content increases and the moisture content decreases with age.

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