

COMPARATIVE EVALUATION OF QUALITY AND COMPOSITION OF OSTRICH, TURKEY AND BROILER MEAT

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Abstract: In this article are presented research data on comparative evaluation of meat quality of various poultry species. The study was made on 5 samples of ostrich, turkey and broiler meat. Samples were weighed 500 to 550 grams. Qualitative and nutritional properties of meat from different species of poultry were estimated. The chemical composition, pH, color, firmness, water holding capacity, cooking loss, drip loss of ostrich, turkey and broiler meat were analyzed. Meat quality studies were carried out according to generally accepted methodologies. Analyses have shown that the highest fat content was in the broiler meat ($p < 0.001$). Ostrich, turkey and broiler meat acidity values were very similar, slightly more distinct in turkey meat ($p < 0.01$). The lowest water holding capacity was established in ostrich, the highest in turkey meat ($p < 0.01$). Comparison in regard to meat firmness, it was observed on the ostrich meat had the highest firmness ($p < 0.01$). Also, the highest cholesterol content was established in the ostrich meat.

Key words: ostrich meat, turkey, broiler chicken, meat quality.

Introduction

Recently, the concept of meat quality has received a great deal of attention from food manufacturers, small traders, as well as public institutions and health centers. Food quality is considered to be the most difficult to define the concept of the food industry, which has become particularly acute problem in recent years (*Brunso et al., 2004*). In addition, it is very difficult to develop common quality standards for the meat market as meat quality concept is changing significantly over time (*Frisby et al., 2005; Bogosavljević-Bošković, 2007*). Consumer needs not only lean, but tasty meat, characterized by good culinary, technological and biological properties (*Jukna et al., 2005*).

The main component of meat is muscle tissue. Proteins are the most valuable part of the muscle, which accounts for about 80 percent muscle tissue materials. The biological value of meat depends on the nutritional, hygienic and organoleptic qualities and calories. Meat quality and its nutritional value depend on the ratio of its components. The muscle tissue has the highest nutritional value, the connective tissue -the lowest (*Skimundris, 2000*). Poultry meat constitutes a substantial portion of protein in the present daily diets (*Kenawi et al., 2007*).

Recently, the public being interested in a healthy diet aspect, particularly increased consumption of turkey meat. Turkey meat compared to other types of meat, has rich in protein, vitamins, minerals and low in fat (*Julian, 2005*).

Lithuania, as well as the worldwide demand for ostrich meat is still increasing. Ostriches are just starting to use as meat animals (*Van Zyl, 2001*). Now people focus on healthy and wholesome nutrition and it influences the use of ostrich meat. Ostrich meat is considered to be healthy product, due to its low intramuscular fat content (16.50% of fat is polyunsaturated fatty acids omega- 3 fatty acids) therefore, it is seen as a new alternative to red meat (*Fisher, 2000*). Ostrich captivates not only new customers but also the researchers seeking to bring to Lithuania a breed that is fleshy and resistant to stress, introducing new technologies in ostrich farming - hatching eggs, progeny, young and adult ostriches to Lithuania. Ostrich meat is characterized by high pH and dark color related to pigment content (*Hoflman, 2001*). Ostrich meat is a healthy red colour, with low cholesterol (*Fisher, 2000; Sales, 1998*). There have been in literature many studies focusing on detection of cholesterol and fatty acid content in ostrich meat (*Sales et al., 1996; Horbañczuk et al., 1998; Sales, 1998*).

The aim of this study was to perform a comparative evaluation of chemical composition and technological properties of ostrich, turkey and broiler meat.

Materials and methods

The research was carried out in 2011 at the Laboratory of Meat Characteristics and Quality Assessment of Lithuanian University of Health Sciences Veterinary Academy. Chemical composition, physical and technological properties were estimated in ostrich, turkey and broiler meat. The study was carried out on 5 samples (3 from female and 2 from male animals) of ostrich, turkey and broiler meat, 500-550 grams of breast (*P. major*) muscle. All groups of birds were reared under the standard feeding and housing conditions. Birds had free access to feed and water throughout the experimental period. They were slaughtered under controlled conditions: ostriches were slaughtered at the age of 10-12 months, turkeys – 17-20 weeks, broilers - 42 days. Samples were stored at temperature of 4 °C. Studies were performed 48 hours after slaughter. The ostrich, turkey and broiler

meat quality was assessed: pH, dry matter and water holding capacity, cooking loss, firmness, drip loss, fat, ash and protein content.

The experiment was performed by using commonly accepted methods. The meat pH was measured with a pH-meter Inolab 3, by a contact electrode „SenTix Sp“, dry materials with automatic instruments „Skaltec SM-1“, drying meat to constant weight at 105 ° C temperature, water-holding capacity by Grau and Hamm method (1953); meat colour by a Minolta Chroma Meter 410, measuring values L * – for lightness, a * – for redness and b * – for yellowness; drip loss – by sample weight reduction, the meat was kept in special bags for 24 hours at + 4°C temperature (*Honikel, 1987*); cooking loss- samples packaged under vacuum – in a circulating water bath at 70°C temperature for 30 min. shear force – according to Warner-Bratzler method (*Bratzler, 1949*); fat by an automatic system for fat extraction Soxhlet method (*Soxhlet, 1879*); protein amount - according to Kjeldal method (*King-Brink et al., 1993*) ash – by organic matter incineration at 600°C. *LST ISO 936:2000 Meat and meat products. Determination of total ash.*

Statistical analysis was carried out using the R statistical package version 2.0.1. (*Gentlemen, Ihaka, 1997*).

Results and Discussion

Meat is the main source of animal protein. Its quality describes many of nutrients, biological and technological indicators. The most important one - the human body's nutrients and, in particular - a high biological value protein needs (*Jukna et. al., 2010*).

Table 1. The chemical composition of poultry

Indicators	Dry material, %	Protein, %	Fat, %	Ash,%	Cholesterol, mg/100g
	X±m _x	X±m _x	X±m _x	X±m _x	X±m _x
Ostrich	24.40±1.33	22.32±2.06	1.82±0.66	3.32±0.06**	71.79±7.51
Turkey	24.50±1.69	22.19±1.97	1.21±1.07*	0.92±0.12*	57.27±7.71
Broiler	25.40±1.38**	21.43±1.47	2.20±0.71***	1.02±0.10	49.91±2.82

***p < 0.001, **p < 0.01, * p < 0.05

In the Table 1 data shows that the highest amount of dry mater (DM) was in broiler meat 25.40 ± 1.38 percent (p < 0.01) and the lowest - ostrich. The difference amounted to 3.94 percent (p < 0.01).

The most valuable part of the meat are proteins. Proteins determine the nutritional value of meat, they influence changes in the technological processes and

physical - chemical parameters of meat. Meat quality and its nutritional value depend on meat components ratio (*Culioli et al., 2003*).

Intramuscular fat increases energy value, improves the taste, but too much body fat inhibits gastric acid secretion and complicates protein digestibility (*Jukna et al., 2007*). Consumers prefer lean meat with reduced content of fat. However, overmuch low intramuscular fat content in worse taste qualities of meat (*Valsta et al., 2005; Jukna et al., 2010*). All tested samples had low amount of intramuscular fat. The highest amount of intramuscular fat was found in broiler meat ($p < 0.001$), the lowest value in turkey meat ($p < 0.05$). The difference between the fat in broiler and turkey meat was 0.99 percent. By comparing turkey and ostrich meat in regard to the fat content, the difference of 0.61 percent was established. Intramuscular fat is the most variable part of the meat. Its coefficient of variation is several times higher than other meat characteristics. It was established that, the most varying intramuscular fat content was in broiler meat and in turkey meat. Fat content influenced meat technological, organoleptic properties and nutritional value of meat (*Honikel, 2004*). In fat are located fat-soluble vitamins and as well as facilitates the A and vitamin D absorption. They used in active substances including the formation of hormones (*Valsta et al., 2005*).

Variation of mineral coefficient in ostrich, turkey and broiler meat was very low. The highest ash content was 3.32 ± 0.06 percent in ostrich meat ($p < 0.01$), while in turkey meat the lowest ash content of 0.92 ± 0.12 percent was found ($p < 0.05$), which coincides with the literature (*Sale, 1998*). Comparing the ostrich and turkey meat ash content, difference was 2.40 percent. Meat mineral elements, except for minor exceptions, are in biologically active and easily assimilated forms for human organism (*Fischer, 2002*).

The cholesterol content of meat ranged between 30 and 120 mg/100g of food (*Valsta et al., 2005*). The highest cholesterol levels we were established in ostrich meat (71.79 ± 7.51 mg/100g) and the lowest in broiler meat (49.91 ± 2.82 mg/100g), the difference was 21.89 mg.

Table 2. Meat technological properties

Indicators	pH	Water holding capacity, mg %	Cooking loss, %	Shear force, kg/cm ²	Drip loss, %.
	$\bar{X} \pm m_x$	$\bar{X} \pm m_x$	$\bar{X} \pm m_x$	$\bar{X} \pm m_x$	$\bar{X} \pm m_x$
Ostrich	$6.0 \pm 0.05^{***}$	61.70 ± 4.33	$20.35 \pm 2.76^*$	2.59 ± 0.77	0.62 ± 0.08
Turkey	$6.6 \pm 0.34^{**}$	$68.80 \pm 1.13^{**}$	11.02 ± 1.48	0.89 ± 0.17	0.37 ± 0.04
Broiler	$5.8 \pm 0.11^{***}$	$64.43 \pm 3.89^{***}$	14.50 ± 2.26	0.48 ± 0.11	0.60 ± 0.28

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

Physical and chemical properties describe meat culinary, technological and nutritional value (*Jukna et al., 2007*). Meat pH is an important indicator of quality, determinative for longer storage possibility and some technological properties (*Wagner, 1999*). The meat physical properties of results analysis are presented in Table 2. The highest pH 6.6 ± 0.34 ($p < 0.01$) was in turkey meat, compared to turkey and broiler meat.

Water holding capacity of meat is an important technological feature, which defines the ability to produce high quality products (*Barton – Garde et al., 2001; Jukna et al., 2007*). The raw meat had good water holding capacity, it didn't emit juice. Ostrich meat was characterized by the lowest water holding capacity 61.70 ± 4.33 percent, whereas the biggest was turkey meat 68.80 ± 1.13 percent. ($p < 0.01$), difference between the ostrich and turkey meat water holding characteristics was 7.1 percent. Water holding capacity of chicken broiler meat was 64.43 ± 3.89 percent. ($p < 0.001$), it differed from the turkey meat by 4.37 percent and 2.73 percent from the ostrich meat.

Meat drip loss depends on the species, age, individual characteristics, body condition and feeding (*Honikel, 2004*). The highest drip loss was established for ostrich meat; it was 0.62 ± 0.08 percent, the lowest was in turkey meat 0.37 ± 0.04 percent.

One of most important technological parameters is cooking loss, which determines the final quantity of the product and organoleptic characteristics. Our analysis showed that the loss was the lowest in turkey meat from 11.02 ± 1.48 percent, the highest loss in ostrich meat 20.35 ± 2.76 percent. Cooking loss of broiler meat was 14.50 ± 2.26 percent and it is only 3.48 percent more than turkey cooking loss and 5.85 percent less than the ostrich meat cooking losses.

Meat firmness is an important indicator of quality. The soft meat is tastier, more easily digested and better absorbed. Firmness depends on the muscle tissue and its protein structure. Comparing meat firmness of different species, it was observed that the lowest firmness was in broiler meat 0.48 ± 0.11 kg/cm², the highest firmness was in ostrich meat 2.59 ± 0.77 kg/cm². Ostrich meat was 5.4 times more firm than broiler meat and 2.9 times than turkey meat.

Conclusions

1. In the study of the chemical composition of poultry meat it was established that the highest mineral content was in ostrich meat 3.32 ± 0.04 percent, and the lowest in turkey 0.92 ± 0.09 percent. The highest amount of intramuscular fat was found in broiler meat ($p < 0.001$), while in turkey meat it was the lowest ($p < 0.05$). Statistically significant difference was determined in dry matter amount between broiler and ostrich meat ($p < 0.01$). The highest cholesterol levels we were found in ostrich meat 71.79 ± 7.51 mg/100g, the lowest in broiler meat

49.91±2.82 mg/100g, but difference statistically not significant. Assessing of meat technological quality indicators, it was observed that the lowest firmness was in broiler meat 0.48 ± 0.11 kg/cm², the highest firmness was in ostrich meat 2.59 ± 0.77 kg/cm². The highest cooking loss was observed in cooked ostrich meat 20.35 ± 1.95 percent, the lowest in turkey 11.02 ± 1.05 percent ($p < 0.01$). Chicken cooking loss of 14.50 ± 1.60 percent, it was 1.4 times lower compared with ostrich meat 20.35 ± 1.95 percent ($p < 0.05$).

2. According to a comparative assessment of meat it was established that ostrich meat had inferior technological properties compared with other poultry species.

Komparativna ocena kvaliteta i sastava nojevog, ćurećeg i mesa brojlera

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Rezime

U ovom radu su predstavljeni podaci komparativnog ispitivanja kvaliteta mesa različitih vrsta živine. Ispitivanje je urađeno na po 5 uzoraka mesa nojeva, ćurki i brojlera, težine 500 do 550 g. Kvalitativne i nutritivne osobine mesa različitih vrsta živine su procenjivane. Hemijski sastav, pH vrednost, mekoća mesa, sposobnost vezivanja vode, kalo kuvanja, kalo mesa nojeva, ćurki i brojlera su analizirani. Ispitivanje kvaliteta mesa je urađeno prema opšte prihvaćenim metodologijama. Rezultati analiza pokazuju da je najveći sadržaj mast imalo meso brojlera ($p < 0.001$). Vrednosti za kiselost mesa nojeva, ćurki i brojlera su bile veoma slične, neznatno više izražene kod ćurećeg mesa ($p < 0.01$). Najniža vrednost za sposobnost vezivanja vode je utvrđena kod nojevog mesa, a najviša kod ćurećeg mesa ($p < 0.01$). U analizi mekoće mesa utvrđeno je da je nojevo meso ima najmanju mekoću odn. najveću čvrstoću mesa ($p < 0.01$). Takođe, najveći sadržaj holesterola je utvrđen u nojevom mesu.

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