Scientific Papers. Series D. Animal Science. Vol. LXIII, No. 1, 2020
ISSN 2285-5750; ISSN CD-ROM 2285-5769; ISSN Online 2393-2260; ISSN-L 2285-5750

STUDIES ON THE FACTORS WHICH INFLUENCE THE CHEMICAL COMPOSITION OF MEAT FROM THE CHICKEN BROILER

Marius Giorgi USTUROI, Roxana Nicoleta RAŢU, Alexandru USTUROI

"Ion Ionescu de la Brad" University of Agricultural Sciences and Veterinary Medicine of Iași, 3 Mihail Sadoveanu Alley, Iași, Romania

Corresponding author email: alexusturoi@yahoo.com

Abstract

In view of the importance that current consumers attach to the quality of the purchased foods, the paper presents the results regarding how the age of slaughter and the type of biological material influence the chemical composition of the meat in the chicken broiler. In this regard, three hen-meat hybrids (one industrial type: Ross-308 and two slow-growing: Hubbard and HB Color) were studied under identical conditions according to the principles of slow growth and slaughtered at age different (63 and 81 days respectively). Chemical analyzes were performed on samples taken from the muscles of the pulp and chest, in equal proportions. The data obtained showed an increase of 0.90% in the proportion of dry matter of meat in specimens slaughtered at 81 days, but also of lipids (by 0.49%) and proteins (by 0.32%). Of the hybrids tested, Hubbard achieved the highest increases in dry matter (1.06%) and protein (0.44%) and lowest increases in lipids (only 0.46%). The conclusion of the study was that, under slow growth conditions, the Hubbard hybrid slaughtered at 81 days of age offers meat with superior chemical characteristics.

Key words*: broiler, chemical composition, meat, slow growing.*

INTRODUCTION

In the consumer market there has always been a high and constant demand for poultry meat (Magdelaine et al, 2008), characterized by a higher biological value given the presence of a large number of essential, but also non-essential amino acids, high content in essential unsaturated fatty acids, especially omega 3 fatty acids and lack of trans fats responsible for the onset of heart disease (Fletcher, 2002).

This state of affairs required the modification of the technologies of bird breeding, from the semi-intensive, to the intensive and then to the industrial growth (Usturoi, 2008), but also by improving the performances of the biological material used so that in the last decades it has tripled the weight of the chicken at 6 weeks, increased by 1.7 times the yield at slaughter, and the feed conversion rate was reduced by half (Dal Bosco et al., 2014).

The continuous decrease of the slaughter age and the improvement of the feed conversion rate (Custură et al., 2011) have led to the economic return of the chicken broiler growth, so the production of poultry meat on a superintensive basis has become a common practice worldwide (Radu and Popescu-Micloşanu, 2012).

Although poultry meat obtained in the industrial system quantitatively satisfies the existing demands (Vukasovic, 2014; Preisinger, 2005), its quality is increasingly questioned, due to its high water content, its less obvious taste, its exaggerated fragility of muscle fibers. etc (Hall and Sandilands, 2007; Husak et al., 2008).

In this context, a distinct segment of consumers has emerged (Hamon, 2010) which requires meat from poultry with low development and late slaughter, fed with cereal mixtures and raised on small farms and with access to the environment (Castellini et al., 2008; Wang et al., 2009; Almasi et al., 2015; Stadig et al., 2016; Popova et al., 2017).

These social factors have led to the emergence of diversified technologies for raising broilers, among which "Label Rouge" technology, ecological technology (Castellini et al., 2002; Dong-Hun et al., 2009; Castellini et al., 2016), different variants of "Certified chickens" with specific provisions for obtaining (Tudorache et al., 2011).

Starting from the aforementioned considerations, it was considered appropriate to

conduct a study regarding the degree of influence of the hybrid and the age of slaughter on the chemical composition of the obtained meat, under the conditions of the slow growth application.

MATERIALS AND METHODS

In order to achieve the proposed purpose, chicken hybrids for meat were studied in which the principles of slow growth were applied, in halls with controlled environment and with access to the external environment; all chicks had the same breeding conditions and were fed the same types of fodder combined.

The experimental factors were represented by the biological material used (three hens hybrids, of which one industrial type: Ross-308 and two slow-growing: Hubbard and HB Color) and the age at which they were sacrificed (63 days and, respectively, 81 days). After slaughtering the chickens from the two series of experience, the meat samples were taken from the muscles of the pulp and chest, from which a common sample (equal proportions of the two types of muscles) was performed, on which the analyzes related to the chemical composition of the meat. The determinations were carried out in accordance with national standards and aimed at:

- water content - by drying method (SR ISO 1442: 2010), which involves exposing a meat sample to a heat source up to constant weight; weight loss, calculated as a percentage, represents the water content;
- the content in the total dry substance - was calculated by difference, according to the relation: DM = 100-water;
- total protein content - by the Kjeldahl method (SR ISO 937: 2007), based on the following principle: the product subjected to analysis in the presence of sulfuric acid and a catalyst, is decomposed by heat into the constituent elements: C, H, O, P, Fe. Following the breakdown of proteins and other nitrogen compounds, ammonium ions are released, which is combined with sulfuric acid to form ammonium bisulphate. Ammonium bisulphate from mineralized by strong alkalization releases ammonia, which is distilled and captured in an acid solution. Knowing the amount of acid needed to neutralize the distilled ammonia, the amount of nitrogen in the sample is calculated;
- the total fat content - was determined by the Soxhlet method (SR ISO 1444: 2008), in an extractor for quantitative separation of fatty substances from a mixture using an organic solvent; after removal of the solvent, it is weighed and expressed as a percentage;
- the content in mineral substances - represents the residue obtained after calcining the sample at 525 ± 25°C, up to a constant weight (SR ISO 936: 2009);
- meat caloricity - was calculated by calculation, according to the Weende scheme: EB (kcal/kg) = 5.7 kcal x g protein + 9.5 kcal x g lipids x 4.2 kcal x g UES).

RESULTS AND DISCUSSIONS

1. **Chemical composition of meat in chicken broiler slaughtered at 63 days of age.** The determination of the water content of the meat studied revealed that the lowest value was in the Hubbard chicks (69.02 ± 12.29%), followed by that of the HB Color chickens (70.91 ± 12.34%) and Ross-308 chicken meat with the highest water content (71.69 ± 12.79%); from a statistical point of view, significant differences were identified between groups Lexp-1 and Lexp-2, and between groups Lc-1 and Lexp-1 distinctly significant differences.

For the dry matter content, the same types of statistical differences were found, respectively significant between Lexp-1 and Lexp-2 and distinctly significant between Lc-1 and Lexp-1, against values of 30.98 ± 6.63% in Hubbard meat, 29.09 ± 6.56% in HB Color and only 28.31 ± 6.53% in Ross-308 chicken meat (Table 1).

Protein content ranged between 19.56 ± 4.22% (Ross-308 meat) and 20.64 ± 4.31% (Hubbard meat), with statistically significant differences between Lc-1 and Lexp groups. -1 and respectively, between lots Lexp-1 and Lexp-2.

Lipid levels were lower in Ross-308 meat (6.63 ± 1.44%) and higher in Hubbard (7.32 ± 1.51%) and HB Color (7.64 ± 1.48%)), so that between the control group and the experimental groups significant statistical differences were identified.

The content in mineral substances ranged from 1.09 ± 0.10% (Ross-308 meat) to 1.36 ± 0.11%

(Hubbard meat), and that in unaccounted extractive substances between 0.65 ± 0, 02% (HB Color) and 1.66 ± 0.11% (Hubbard); if for statistical substances no statistical differences were reported between groups, for SEN significant statistical differences between experimental groups (Lexp-1 and Lexp-2) were identified.

Caloricity of meat correlated with its content in protein and lipids, being at levels of only 178.81 ± 22.6 kcal/100 g in the case of Ross-308 chickens, of 194.16 ± 22.27 kcal/100 g at Hubbard and 187.49 ± 22.81 kcal/100 g at HB Color; Between the Lc-1 and Lexp-1 groups, distinctly significant statistical differences were identified, and in the comparisons of Lc-1 vs. Lexp-2 and Lexp-1, respectively. Lexp-2 only significant differences.

All the analyzed characteristics showed a good homogeneity, except for the fat content, where the calculated values for the coefficient of variation (V% = 12.59-15.06) show a medium variability (Table 1).

Table 1. Meat chemical composition of hens hybrid slaughtered at 63 days

Parameters	Lots	Statistical estimators (n = 10)			
		$\bar{X} \pm s_{\bar{x}}$	V %	Min.	Max.
Water (%)	Lc-1 (Ross-308)	71.69±12.79	7.58	68.16	73.40
	Lexp-1 (Hubbard)	69.02±12.29	6.62	67.59	71.40
	Lexp-2 (HB Color)	70.91±12.34	5.09	69.45	71.48
	Meaning of differences	Lc-1 vs Lexp-1: Fα0.001 (15.38)> $\hat{F}$ (14.39)> Fα0.01 (8.29) at 1; 18 GL **(**)** Lc-1 vs Lexp-2: $\hat{F}$ (0.92) < Fα0.05 (4.41) at 1;18 GL **(NS)** Lexp-1 vs Lexp-2: Fα0.01 (8.29) > $\hat{F}$ (7.02) > Fα0.05 (4.41) at 1; 18 GL **(*)**			
Dry matter (%)	Lc-1 (Ross-308)	28.31±6.53	7.89	26.90	31.50
	Lexp-1 (Hubbard)	30.98±6.63	6.65	29.00	33.50
	Lexp-2 (HB Color)	29.09±6.56	5.23	28.50	32.00
	Meaning of differences	Lc-1 vs Lexp-1: Fα0.001 (15.38)> $\hat{F}$ (14.81)> Fα0.01 (8.29) at 1; 18 GL **(**)** Lc-1 vs Lexp-2: $\hat{F}$ (2.92) < Fα0.05 (4.41) at 1;18 GL **(NS)** Lexp-1 vs Lexp-2: Fα0.01 (8.29) > $\hat{F}$ (6.91) > Fα0.05 (4.41) at 1; 18 GL **(*)**			
Protein (%)	Lc-1 (Ross-308)	19.56±4.22	6.44	18.40	20.67
	Lexp-1 (Hubbard)	20.64±4.31	7.50	18.90	21.62
	Lexp-2(HB Color)	19.68±4.29	6.24	18.17	20.65
	Meaning of differences	Lc-1 vs Lexp-1: Fα0.01 (8.29) > $\hat{F}$ (5.17) > Fα0.05 (4.41) at 1; 18 GL **(*)** Lc-1 vs Lexp-2: $\hat{F}$ (0.52) < Fα0.05 (4.41) at 1;18 GL **(NS)** Lexp-1 vs Lexp-2: Fα0.01 (8.29) > $\hat{F}$ (4.94) > Fα0.05 (4.41) at 1; 18 GL **(*)**			
Lipids (%)	Lc-1 (Ross-308)	6.63±1.44	12.59	4.26	9.67
	Lexp-1 (Hubbard)	7.32±1.51	15.06	5.11	11.20
	Lexp-2(HB Color)	7.64±1.48	14.34	6.03	10.70
	Meaning of differences	Lc-1 vs Lexp-1: Fα0.01 (8.29) > $\hat{F}$ (5.02) > Fα0.05 (4.41) at 1; 18 GL **(*)** Lc-1 vs Lexp-2: Fα0.01 (8.29) > $\hat{F}$ (7.98) > Fα0.05 (4.41) at 1; 18 GL **(*)** Lexp-1 vs Lexp-2: $\hat{F}$ (3.24) < Fα0.05 (4.41) at 1;18 GL **(NS)**			
Ash (%)	Lc-1 (Ross-308)	1.09±0.10	2.98	1.07	1.15
	Lexp-1 (Hubbard)	1.36±0.11	8.24	1.21	1.80
	Lexp-2(HB Color)	1.11±0.09	9.60	1.00	1.78
	Meaning of differences	Lc-1 vs Lexp-1: $\hat{F}$ (1.11) < Fα0.05 (4.41) at 1; 18 GL **(NS)** Lc-1 vs Lexp-2: $\hat{F}$ (0.14) < Fα0.05 (4.41) at 1; 18 GL **(NS)** Lexp-1 vs Lexp-2: $\hat{F}$ (1.09) < Fα0.05 (4.41) at 1; 18 GL **(NS)**			
UES (%) (unclaimed extractive substances)	Lc-1 (Ross-308)	1.03±0.10	9.90	0.06	1.67
	Lexp-1 (Hubbard)	1.66±0.11	7.06	0.94	2.01
	Lexp-2(HB Color)	0.65±0.02	6.52	0.29	0.94
	Meaning of differences	Lc-1 vs Lexp-1: $\hat{F}$ (3.11) < Fα0.05 (4.41) at 1; 18 GL **(NS)** Lc-1 vs Lexp-2: $\hat{F}$ (1.14) < Fα0.05 (4.41) at 1; 18 GL **(NS)** Lexp-1 vs Lexp-2: Fα0.01 (8.29) > $\hat{F}$ (4.59) > Fα0.05 (4.41) at 1; 18 GL **(*)**			
Caloric value (kcal/100 g)	Lc-1 (Ross-308)	178.81±22.64	3.58	175.0	180.1
	Lexp-1 (Hubbard)	194.16±22.27	9.92	177.0	213.2
	Lexp-2(HB Color)	187.49±2281	342	1845	1914
	Meaning of differences	Lc-1 vs Lexp-1: Fα0.001 (15.38)> $\hat{F}$ (14.93)> Fα0.01 (8.29) at 1; 18 GL **(**)** Lc-1 vs Lexp-2: Fα0.01 (8.29) > $\hat{F}$ (7.75) > Fα0.05 (4.41) at 1; 18 GL **(*)** Lexp-1 vs Lexp-2: Fα0.01 (8.29) > $\hat{F}$ (6.84) > Fα0.05 (4.41) at 1; 18 GL **(*)**			

2. The chemical composition of the meat in the chicken broiler slaughtered at the age of 81 days. Following the determinations made, a 10.98%) and in Hubbard (67.96 ± 10.57%), hence the significant differences between the two experimental and respective groups, distinctly significant between Lc-2 and Lexp-3. Correspondingly, Ross-308 meat had a lower dry content (28.97 ± 7.02%), compared to HB Color (30.07 ± 7.42%) and Hubbard (32.04 ± 7.73%); The same statistical differences were maintained between groups, is significant between Lexp-3 and Lexp-4 groups and distinctly significant between Lc-2 and Lexp-3. higher value of the water content was obtained in the meat of Ross-308 chickens (71.03 ± 11.73%) and lower in HB Color (69.93 ± From the protein point of view, the meat obtained from the Ross-308 hybrid had the lowest content, of only 19.74 ± 3.97%, followed by that of the HB Color hybrid with 20.01 ± 4.07% and Hubbard with 21.08 ± 4.29% protein. Differences with statistical significance between the Lexp-3 group and the Lc-2 and the Lexp-4 groups respectively (Table 2) were obtained from the statistical analysis.

Table 2. Meat chemical composition of hens hybrid slaughtered at 81 days

Parameters	Lots	Statistical estimators (n = 10)			
		$\bar{X} \pm s_{\bar{x}}$	V %	Min	Max
Water (%)	Lc-2 (Ross-308)	71.03±11.73	5.86	68.6	72.7
	Lexp-3 (Hubbard)	67.96±10.57	4.94	66.7	69.6
	Lexp-4 (HB Color)	69.93±10.98	2.48	68.4	70.1
	Meaning of differences	Lc-2 vs Lexp-3: Fα0.001 (15.38)> $\hat{F}$ (13.94)> Fα0.01 (8.29) at 1; 18 GL **(**)** Lc-2 vs Lexp-4: $\hat{F}$ (1.11) < Fα0.05 (4.41) at 1;18 GL **(NS)** Lexp-3 vs Lexp-4: Fα0.01 (8.29) > $\hat{F}$ (7.56) > Fα0.05 (4.41) at 1; 18 GL **(*)**			
Dry matter (%)	Lc-2 (Ross-308)	28.97±7.02	7.65	25.6	33.3
	Lexp-3 (Hubbard)	32.04±7.73	8.15	26.1	34.7
	Lexp-4 (HB Color)	30.07±7.42	6.25	27.4	31.5
	Meaning of differences	Lc-2 vs Lexp-3: Fα0.001 (15.38)> $\hat{F}$ (13.87)> Fα0.01 (8.29) at 1; 18 GL **(**)** Lc-2 vs Lexp-4: $\hat{F}$ (1.09) < Fα0.05 (4.41) at 1;18 GL **(NS)** Lexp-3 vs Lexp-4: Fα0.01 (8.29) > $\hat{F}$ (7.13) > Fα0.05 (4.41) at 1; 18 GL **(*)**			
Protein (%)	Lc-2 (Ross-308)	19.74±3.97	6.90	17.1	23.0
	Lexp-3 (Hubbard)	21.08±4.29	7.99	18.6	24.1
	Lexp-4 (HB Color)	20.01±4.07	7.81	18.8	23.5
	Meaning of differences	Lc-2 vs Lexp-3: Fα0.01 (8.29) > $\hat{F}$ (6.68) > Fα0.05 (4.41) at 1; 18 GL **(*)** Lc-2 vs Lexp-4: $\hat{F}$ (0.61) < Fα0.05 (4.41) at 1;18 GL **(NS)** Lexp-3 vs Lexp-4: Fα0.01 (8.29) > $\hat{F}$ (4.73) > Fα0.05 (4.41) at 1; 18 GL **(*)**			
Lipids (%)	Lc-2 (Ross-308)	7.17±1.90	8.45	5.4	10.0
	Lexp-3 (Hubbard)	7.78±1.97	7.01	6.0	9.8
	Lexp-4 (HB Color)	8.12±2.04	8.28	6.7	11.0
	Meaning of differences	Lc-2 vs Lexp-3: Fα0.01 (8.29) > $\hat{F}$ (6.53) > Fα0.05 (4.41) at 1; 18 GL **(*)** Lc-2 vs Lexp-4: Fα0.01 (8.29) > $\hat{F}$ (6.87) > Fα0.05 (4.41) at 1; 18 GL **(*)** Lexp-3 vs Lexp-4: $\hat{F}$ (1.02) < Fα0.05 (4.41) at 1;18 GL **(NS)**			
Ash (%)	Lc-2 (Ross-308)	1.06±0.08	5.59	0.8	1.5
	Lexp-3 (Hubbard)	1.30±0.19	9.10	1.1	2.1
	Lexp-4 (HB Color)	1.12±0.12	6.05	0.9	1.7
	Meaning of differences	Lc-2 vs Lexp-3: $\hat{F}$ (0.98) < Fα0.05 (4.41) at 1; 18 GL **(NS)** Lc-2 vs Lexp-4: $\hat{F}$ (0.09) < Fα0.05 (4.41) at 1; 18 GL **(NS)** Lexp-3 vs Lexp-4: $\hat{F}$ (0.57) < Fα0.05 (4.41) at 1; 18 GL **(NS)**			
UES (%) (unclaimed extractive substances)	Lc-2 (Ross-308)	1.00±0.13	7.99	0.7	3.1
	Lexp-3 (Hubbard)	1.88±0.11	6.46	0.7	2.9
	Lexp-4 (HB Color)	0.82±0.06	6.39	0.3	1.8
	Meaning of differences	Lc-2 vs Lexp-3: $\hat{F}$ (1.11) < Fα0.05 (4.41) at 1;18 GL **(NS)** Lc-2 vs Lexp-4: Fα0.01 (8.29) > $\hat{F}$ (5.15) > Fα0.05 (4.41) at 1;18 GL **(*)** Lexp-3 vs Lexp-4: Fα0.01 (8.29) > $\hat{F}$ (5.01) > Fα0.05 (4.41) at 1;18 GL **(*)**			
Caloric value (kcal/100 g)	Lc-2 (Ross-308)	184.84±22.58	7.91	173.5	192.1
	Lexp-3 (Hubbard)	201.97±23.61	9.36	197.7	211.0
	Lexp-4 (HB Color)	194.64±23.90	8.99	182.5	205.8
	Meaning of differences	Lc-2 vs Lexp-3: Fα0.001 (15.38)> $\hat{F}$ (14.98)> Fα0.01 (8.29) at 1; 18 GL **(**)** Lc-2 vs Lexp-4: Fα0.01 (8.29) > $\hat{F}$ (7.59) > Fα0.05 (4.41) at 1; 18 GL **(*)** Lexp-3 vs Lexp-4: Fα0.01 (8.29) > $\hat{F}$ (6.88) > Fα0.05 (4.41) at 1; 18 GL **(*)**			

CONCLUSIONS

From the data regarding the water content of the meat it resulted that it reduced, on average, by 0.90% by increasing the age of slaughter of the birds, but in a greater proportion to the hybrids created for the slow growth (by 1.06% at Hubbard and 0.98% at HB Color) and lower at the Ross-308 industrial hybrid (0.66%).

The slaughter of birds at an older age also influenced the meat content in protein (higher by 0.32%) and lipids (higher by 0.49%), but with differences printed by the biological material tested; thus, at Ross-308 the lowest quantitative increase in protein (by 0.18%) and the highest for lipids (by 0.54%), while in the Hubbard chickens the situation was reversed in the sense that they had the highest increase in protein content (0.44%) and the lowest for lipids (0.46%).

Meat composition in mineral substances was within normal limits, with values slightly higher at Hubbard (1.30-1.36%) and lower at Ross-308 (1.06-1.09%), which is valid for non-protein nitrogenous substances for which levels of 0.65-1.88% were found.

The conclusion of our study was that the chicken broiler subjected to slow growth must be slaughtered at 81 days, an age that allows obtaining a higher meat in the aspect of chemical composition; Of the hybrids tested, Hubbard provided the best chemical parameters of the meat and, together with the superior production results, qualifies it for slow growth.

REFERENCES

Almasi, A., Andrassyne, B.G., Milisits, G., Kustosne, P.O., Suto, Z. (2015). Effects of different rearing systems on muscle and meat quality traits of slow- and medium-growing male chickens. *Brit. Poultry Sci*., 56, 320–324.

Castellini, C., Mugnai, C., Dal Bosco, A. (2002). Meat quality of three chicken genotypes reared according to the organic system. *Italian journal of food science*, 14 (4), 401–412.

Castellini, C., Berri, C., Le Bihan-Duval, E., Martino, G. (2008). Qualitative attributes and consumer perception of organic and free-range poultry meat. World's *Poultry Science Journal*, 64, 500–512.

Castellini, C., Mugnai, C., Moscati, L., Mattioli, S., Amato, M., Mancinelli, A., Dal Bosco, A. (2016). Adaptation to organic rearing system of eight different chicken genotypes: behaviour, welfare and performance. *Italian journal of animal science*, 15(1), 37–46.

Custură, I., Van, I., Tudorache, M., Popescu-Micloşanu, E., Pârvuleţ, C. (2011). Researches about influence of feed paramethers on slaughtering performances in free-range chickens. *Scientific papers. Series D. Animal science*, LIV, 289–293.

Dal Bosco, A., Mugnai, C., Amato, M., Piottoli, L., Cartoni, A., Castellini, C. (2014). Effect of slaughtering age in different commercial chicken genotypes reared according to the organic system: 1. Welfare, carcass and meat traits. *Italian journal of animal science*, 13(2), 2042–2050.

Dong-Hun, K., Soo-Hyun, C., Jin-Hyoung, K., Pil-Nam, S., Jong-Moon, L., Cheorun, J., Dong-Gyun, L. (2009). Comparison of the Quality of the Chicken Breasts from Organically and Conventionally Reared Chickens. *Korean Journal Food Science Animals Resources*, 29(4), 409–414.

Fletcher, D.L. (2002). Poultry meat quality. *World's Poultry Science Journal*, 58, 131–145.

Hall, C., Sandilands, V. (2007). Public attitudes to the welfare of broiler chickens. *Animal Welfare*, 16, 499–512.

Hamon, J.F. (2010). The alternative broiler market: history, evolution and future. *Book of abstracts XIIIth European Poultry Conference*, Tours, France, 579.

Husak, R.L., Sebranek, J.G., Bregendahl, K. (2008). A survey of commercially available broilers marketed as organic, free-range, and conventional broilers for cooked meat yields, meat composition, and relative value. *Poultry Science*, 87, 2367–2376.

Magdelaine, P., Spiess, M.P., Valceschini, E. (2008). Poultry meat consumption trends in Europe. *World's Poultry Science Journal*, 64(1), 53–64.

Popova, T., Ignatova, M., Petkov, E. (2017). Carcass quality and meat chemical composition in two lines of slow growing chickens and their crosses. *Proc. VIII International Agricultural Symposium "AGROSYM",* 2133–2139.

Preisinger, R. (2005). Development, state and perspectives of poultry production. *Zuchtungskunde*, 77, 502–507.

Radu, C. V., Popescu-Micloşanu, E. (2012). Comparative study about production and slaughtering performances in an industrial company with ROSS 308 standard chicken hybrid. *Scientific papers. Series D. Animal science*, LV, 214–219.

Stadig, L.M., Rodenburg, T.B., Reubens, B., Aerts, J., Duquenne, B., Tuyttens, F.A.M. (2016). Effects of free-range access on production parameters and meat quality, composition and taste in slow-growing broiler chickens. *Poultry Science*, 95, 2971–2978.

Tudorache, M., Van, I., Custură, I., Popescu-Micloşanu, E., Popa, A. (2012). Study on unit cost of certificate-type broilers. *Scientific papers, Series D, Animal science*, LV, 250–255.

Usturoi, M.G. (2008). *Birds growth/Creşterea păsărilor*. Iaşi, RO: Ion Ionescu de la Brad Publishing House.

Vukasovic, T. (2014). European meat market trends and consumer preference for poultry meat in buying decision making process. *Worlds Poultry Science Journal*, 70(2), 289–301.

Wang, K.H., Shi, S.R., Dou, T.C., Sun, H.J. (2009). Effect of a free-range raising system on growth performance, carcass yield, and meat quality of slow-growing chicken. *Poultry Science*, 88, 2219–2223.