

CONTRIBUTIONS TO THE KNOWLEDGE OF CHEMICAL COMPOSITION AND ENERGETIC VALUE OF THE MEAT PROVIDED FROM BROILER CHICKENS “Ross – 308”

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Abstract

Chemical features of meat are given by the proprieties of its component elements, knowing the fact that in meat composition are found many types of tissues: striated muscular, adipose, bone, lax, fibrous, cartilaginous, epithelial, nervous etc. Chemical composition influences, in a direct way, the meat nutritive value. Meat contains water, in average, at mammals – cattle, sheep, swine – 66.52% and at birds – hens, turkeys, geese, ducks – 61.64% and dry matter (protides, lipids, glucides, mineral salts, vitamins, enzymes) – 33.48% at mammals, respectively 38.36% at birds. Appreciated as a mixture of different tissues, meat presents a variable chemical composition function of many factors (specie, breed, age, fattening state, portion of the carcass which is analysed etc). Determination of the organic and inorganic chemical compounds of foods represented a tendency which was always actually in the research regarding food quality and food safety of the human consumer.

Key words: chemical composition, birds' meat, muscles

INTRODUCTION

The values of the obtained chemical composition, generate a special interest, because in the literature are very few references, in which to be made a complete analysis of bird meat also on muscles categories, including from cholesterol point of view, fact which allow to elaborate some right dietary recipes based on this food, for the consumers with different ages, with digestive and cardiovascular diseases.

More recent studies presented in a paper published by M., 2004, describe the chemical composition of the pectoral muscles gathered from broiler chickens belonging to the commercial hybrid “ISA”. The birds used in his study belonged to a phenotype with slow growth and were exploited into a rearing system alternative-organic. The results obtained by the author, as also the ones from literature, are not, as we mention above, sufficient to know in detail the chemical composition of birds', reason for us to realise the current research.

MATERIAL AND METHODS

Determination of water quantity and dry matter (D.M.) from the studied muscles (profound pectoral muscle, superficial pectoral muscle, biceps gill muscle, medial gastrocnemius muscle) was realised through oven drying method.

To determine the quantity of mineral substances which are in the studied muscles (profound pectoral muscle, superficial pectoral muscle, biceps gill muscle, medial gastrocnemius muscle) was used the calcinations method.

Appreciation of the fat quantity from the studied muscles was realised through direct Soxhlet method, at the extraction device for quantitative separation of the substances from an organic solvent, Velp Scientific – SER 148 model.

To determine the protein content from the studied muscles was used Kjeldahl method, adapted to Velp Scientifica system, realised by a DK6 digestion unit and a UDK7 distillation unit.

The content of studied muscles in extractive substances without nitrogen (SEN) was mathematically calculated, being in fact the difference after from DM (%) were drop

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the proportion of the others chemical compounds, mineral or organic.

To realize a complete and ample image on the nutritive-dietetic qualities of bird meat was realised also *the concretion of the calorificity of the studied muscles* using the theoretical formula based on the gross amount of caloric energy released at burning a quantity of 1 g proteins, fat and glucides in the calorimetric bomb.

RESULTS AND DISCUSSIONS

In table 1 and 2 are presented the obtained results after determination of chemical composition of meat, respectively the content in: water-%; dry matter-%; mineral substances-%; lipids-%; proteins-%; extractive substances without nitrogen (S.E.N.)-%.

Table 1 Chemical composition from the pectoral muscles ("white meat") and their energetic value

Studied muscle	Sex	Determinations	$\bar{X} \pm s_{\bar{x}}$ (%)	CV %	Min. (%)	Max. (%)	Energetic value (kcal/100 g)
Pectoral superficial	♂	Water	73.97±0.23	1.03	72.84	75.16	143.98
		DM	26.03±0.23	2.93	24.84	27.15	
		Mineral substances	1.28 ^a ±0.03	10.41	1.06	1.48	
		Lipids	1.03 ^a ±0.02	8.14	0.96	1.19	
		Proteins	23.01±0.20	2.86	28.95	25.45	
		SEN	0.71 ^a ±0.08	16.02	0.43	0.95	
	♀	Water	73.16±0.28	1.26	72.95	75.70	143.10
		DM	26.84±0.28	3.61	24.30	27.10	
		Mineral substances	1.48 ^d ±0.02	7.11	1.22	1.51	
		Lipids	1.19 ^a ±0.03	7.13	1.02	1.26	
		Proteins	22.95 ^b ±0.29	4.24	21.22	24.29	
		SEN	0.80±0.12	11.94	0.44	0.82	
Pectoral profound	♂	Water	74.38±0.17	0.75	73.73	75.50	141.41
		DM	25.62±0.17	2.22	24.49	26.25	
		Mineral substances	1.15 ^a ±0.02	2.24	0.97	1.24	
		Lipids	1.13 ^a ±0.02	6.04	1.07	1.29	
		Proteins	22.45±0.13	2.16	21.55	23.15	
		SEN	0.71±0.05	12.40	0.46	1.00	
	♀	Water	75.03±0.29	1.27	73.40	76.39	138.60
		DM	24.97±0.29	3.81	23.61	26.60	
		Mineral substances	1.24 ^b ±0.03	7.56	1.11	1.38	
		Lipids	1.27 ^d ±0.03	7.12	1.04	1.30	
		Proteins	21.84±0.27	4.14	20.56	23.26	
		SEN	0.71±0.04	15.01	0.48	0.90	

ANOVA test – for each chemical and muscle determination, comparatively on sexes:

^{ab} significant differences ($\hat{F} > F$. Tab. α 0.05 at 1;10 GL);

^{ac} distinct significant differences ($\hat{F} > F$. Tab. α 0.01 at 1;10 GL);

^{ad} very significant differences ($\hat{F} > F$. Tab. α 0.001 at 1;10 GL).

Table 2 Chemical composition from member's muscles ("red meat") and their energetic value

Studied muscle	Sex	Determinations	$\bar{X} \pm s_{\bar{X}}$ (%)	CV %	Min. (%)	Max. (%)	Energetic value (kcal/100 g)	
Biceps gill	♂	Water	73.16±0.31	1.34	72.10	74.91	162.62	
		DM	26.84±0.31	3.68	25.09	27.90		
		Mineral substances	1.05±0.02	7.58	0.93	1.22		
		Lipids	4.35 ^a ±0.07	4.70	3.98	4.67		
		Proteins	20.78±0.28	4.28	19.25	21.80		
			SEN	0.66±0.09	10.40	0.48	0.83	
	♀	Water	72.43±0.34	1.54	71.13	74.49	170.07	
		DM	27.57±0.34	4.07	25.50	28.87		
		Mineral substances	1.05±0.02	6.86	0.96	1.21		
		Lipids	5.22 ^d ±0.08	4.42	4.84	5.50		
Proteins		20.53±0.33	5.30	18.60	21.92			
		SEN	0.63±0.05	11.81	0.44	0.84		
Lateral gastrocnemius	♂	Water	73.12±0.48	2.06	71.08	75.22	172.11	
		DM	26.88±0.48	5.73	24.77	28.92		
		Mineral substances	0.88 ^a ±0.03	10.30	0.72	1.00		
		Lipids	6.54 ^b ±0.06	3.21	6.26	6.79		
		Proteins	18.85±0.43	7.37	16.93	20.61		
			SEN	0.61±0.06	11.64	0.41	0.88	
	♀	Water	72.33±0.49	2.22	69.76	74.24	181.02	
		DM	27.67±0.49	5.84	25.75	30.24		
		Mineral substances	1.03 ^a ±0.02	7.87	0.88	1.14		
		Lipids	8.10 ^d ±0.07	2.92	7.77	8.45		
Proteins		18.08±0.47	8.48	16.15	20.50			
		SEN	0.47±0.04	11.95	0.32	0.60		

ANOVA test – for each chemical and muscle determination, comparatively on sexes:

^{ab} significant differences ($\hat{F} > F$. Tab. α 0.05 at 1;10 GL);

^{ac} distinct significant differences ($\hat{F} > F$. Tab. α 0.01 at 1;10 GL);

^{ad} very significant differences ($\hat{F} > F$. Tab. α 0.001 at 1;10 GL).

The main aspects drawn from the presented data are:

✓ *Water content* which varied:

at males – between 73.12%, in median gastrocnemius muscle and 74.38%, in profound pectoral muscle;

at females – between 72.33%, in median gastrocnemius muscle and 75.03%, in profound pectoral muscle;

✓ *Content of the protein in meat oscillated:*
at males – between 18.85%, in median gastrocnemius muscle and 23.01%, in profound pectoral muscle;

at females – between 18.08%, in median gastrocnemius muscle and 22.95%, in profound pectoral muscle.

The mentioned values are between the ones cited in literature for hens' broiler chickens (20.1% - *Banu C., et al., 2002*; 23.8 – 24.5 % - *Vacaru-Opriș I., et al., 2004*; 24% - *Ristic M., 2004*; 17.13-23.80% - *Radu-Rusu R., 2009*).

✓ *Content of lipids in meat varied:*

at males – between 1.03%, in superficial pectoral muscle and 6.54%, in median gastrocnemius muscle;

at females – between 1.19%, in superficial pectoral muscle and 8.10%, in median gastrocnemius muscle.

Was also observed that in biceps gill muscles the content in lipids was closer to the one from median gastrocnemius muscle (4.35%), at male and 5.22%, at females and

very different from the one in pectoral muscles. Between sexes we remarked a greater predisposition for fat deposits at females face to males;

Meat content in extractive substances without nitrogen (S.E.N.) was dependent to the one in proteins and lipids, varying between 0.47% in median gastrocnemius muscle, at females and 0.80%, in superficial pectoral muscle, also at females.

Content of meat in mineral substances varied insignificant between muscles and between sexes, reaching the value of 1.03%, in median gastrocnemius muscle, at females and 1.48%, in superficial pectoral muscle, also at females.

In pectoral muscles (superficial and profound) and mainly, in superficial pectoral muscle, which at birds formed “white meat” was founded a *higher content in proteins* (21.84% - 24.45%) than in the biceps gill muscles and more over, in median gastrocnemius muscle, which form the “red meat” (18.08% - 20.78%); at the same time, *the content in lipids* was higher at “red meat” (4.35% - 8.10%) and very low at “white meat” (1.03% - 1.27%), which could be considered to be a real dietetic meat.

Almost for all the presented situations, the values of variation coefficients showed a very good homogeneity of the studied characters (CV% < 10.00). Between means were differences statistically assured in according with the data from tables 1 and 2.

Meat caloricity was correlated with the level of lipids, so if in median gastrocnemius muscle from females, was obtained the highest content in lipids (8.10 ± 0.07%), at this muscle was recorded the highest caloricity of meat (181.02 kcal/100 g). Conversely, the muscle with the lowest content in lipids, respectively superficial pectoral muscle from males (1.03%) had the lowest value for caloricity (138.60 kcal/100 g).

Generally, the values by us for meat energetic value are close to the ones in literature, (177.00 kcal/100g – Banu C., et al., 2002; 200.28 kcal/100 g – Radu-Rusu R., 2009).

CONCLUSIONS

Content of the studied meat in proteins was, in average, of: 23.01±0.20%, at males and of 22.95±0.29%, at females, in superficial pectoral muscle; 22.45±0.13%, at males and of 21.84±0.27%, at females, in profound pectoral muscle; 20.78±0.28%, at male and 20.53±0.33%, at females; in biceps gill muscles; 18.85±0.43%, at male and of 18.08±0.47%, at females, in median gastrocnemius muscle. Between sexes was remarked a higher content in proteins at males in comparison with females.

Under the aspect of meat caloricity, we mention that this one was correlated with the level of lipids from meat; so, in member's muscles (biceps gill and median gastrocnemius), at which the content in lipids was higher, was recorded also the highest value for caloricity, while at superficial and profound pectoral muscles, which have the lowest content in lipids, was recorded the lowest caloricity of the studied meat.

Based on the above mentioned appreciations it is clearly drawn *the very good quality of the meat studied by us*. At the same time, we underline the superiority of “white meat” – (superficial and profound pectoral muscles) regarding nutritive and dietetic value face to “red meat” (biceps gill and median gastrocnemius muscles). At “white meat” caloricity was lower, due to the decreased content in lipids; moreover was determinate a higher protein content face to “red meat”.

REFERENCES

- [1] Banu, C., et al., 2002 - Calitatea și controlul calității produselor alimentare. Editura Agir, București
- [2] Radu-Rusu, R.M., 2009 - Contribuții la cunoașterea morfologiei, structurii și a însușirilor fizico-chimice ale unor mușchi somatici, proveniți de la puii broiler de găină. Teză de doctorat, USAMV, Iași
- [3] Ristic, M., 2004 - Meat quality of organically produced broilers, Rev. World Poultry, Vol. 20, No. 8, 2004
- [4] Vacaru-Opriș, I., et al., 2004 - Tratat de Avicultură, vol. III. Editura Ceres, București.