STUDIES REGARDING THE CHEMICAL COMPOSITION OF SOME POULTRY EDIBLE ORGANS

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Abstract

Even if at world level are consumed important quantities of poultry organs, research regarding their quality are extremely rare.

The aim of the study was to establish if are some correlations between slaughtering age of poultry and chemical composition of two edible organs (heart and gizzard).

So were settled up 6 experimental batches (3 for gizzards and 3 for hearts), differencing by the age of slaughtered poultries, as follows: P_1 and I_1 = gizzards and hearts gathered from chickens slaughtered at 35 days; P_2 and I_2 = gizzards and hearts gathered from chickens slaughtered at 40 days; P_3 and I_3 = gizzards and hearts gathered from chickens slaughtered at 42 days. Determinations were made on fresh products and aimed content in water, dry matter, proteins and NES; also we calculate the energetic value.

Regarding protein content of gizzards and hearts, our data shown a decreasing of the values at the same time with the increasing of slaughtering age; the differences between those 3 batches being without statistical significance ($P>0.05$).

Regarding fat content, both for hearts and gizzards, the best values were founded at chickens slaughtered at 42 days, higher with 0.91–2.78% in case of hearts and with 3.08–7.20% for gizzards face to the situation for the others slaughtering. Statiscally speaking, the differences were very significant ($P<0.01$) for gizzards (P_1 vs. P_3) as well as for hearts (I_1 vs. I_3).

Through the obtained results for hybrid Ross 308, we could say that slaughtering age didn't influence very significant the chemical composition of gizzards and hearts, with the exception of fat content, which increase with increasing of slaughtering age.

Key words: poultry, slaughtering, gizzards, hearts, chemical composition

INTRODUCTION

Meat and meat products form an important segment in human diet, because those ones provide essential nutritive elements, which couldn't be obtained from vegetables and derived products [3].

Consumption of poultry meat and edible organs considerably increased in the last years, in Romania. Poultry gizzards and hearts are consumed on a large scale due to their low price, low content in fat and due to a short period of time for their preparation [2].

The importance of edible by products is underlined by their nutritive value which is suitable for consumers [6].

The quality of animal edible organs depend of various factors: breed, race, rearing system, physiological and health state of animal, sex, age, weight, manipulation and post-mortem processing [4].

Being known the fact that intensive rearing of meat poultry has as result the obtaining of meat in a short period of time and with a maximum economical efficiency, the aim of the current study was to establish if there are correlations between slaughtering age of the birds and chemical composition of two poultry edible organs (heart and gizzard).

Till now determination of chemical components of gizzard and heart gathered from poultry slaughtered at different ages, wasn't a priority in the research regarding quality and human consumers' food safety.

MATERIALS AND METHODS

The studied material was represented by gizzards and hearts gathered from hybrid Ross 308. Research were effectuated based

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on an experimental design, organized on 6 experimental batches (3 for gizzards and 3 for hearts), differentiating by slaughtering age of poultry broiler, encoded as follows: P_1 and I_1 = gizzards and hearts gathered from poultry slaughtered at 35 days; P_2 and I_2 = gizzards and hearts from poultry slaughtered at 40 days; P_3 and I_3 = gizzards and hearts from poultry gathered at 42 days.

For each studied batch were formed 5 samples, each of them with a weight of 0.5 kg, which were minced and homogenised and from which were gathered samples for determinations.

Determinations were realized on fresh products and aimed the content in water, dry matter, proteins, fats, ash and non-nitrogenous extractive substances (NES), and also was calculated the energetic value.

Determination of dry matter content was realised by drying in oven [7], and water content resulted as a difference in according with the formula: Water (%) = 100% - DM (%).

Proteins from those two poultry edible organs were determined by Kjeldahl method [11].

Establishing of lipids content was effectuated with Soxhlet method [12].

Ash content was determined in according with SR ISO 936:1998 [10], and non-nitrogenous extractive substances were calculated as difference with the formula: NES (%) = 100 – (Water% + Ash% + Proteins% + Lipids%) [8].

Energetic value of poultry gizzard and heart (kcal/100g) was calculated using the formula: (4.27 kcal * Proteins%) + (9.02 kcal * Lipids%) + (3.87 kcal * NES%) [9].

The obtained data were subjected to some statistical calculations, using ANOVA algorithm included in MsExcel.

RESULTS AND DISCUSSION

- Chemical composition of gizzards

The gathered samples from poultry gizzard show a decrease of water content at poultry slaughtered at advanced ages. So, samples gathered from poultry slaughtered at 35 days (batch P_1) recorded the highest mean value, respectively 79.76±0.04%, while the samples from poultry slaughtered at 40 days (batch P_2) had a water content of 79.64±0.03%, and the ones gathered from poultry slaughtered at 42 days (batch P_3) of 79.55±0.02%. The calculated values for variation coefficient were inside interval 0.06-0.10% fact which shown a very homogenous character. Statistically speaking were enlightened significant statistical differences between batches P_1 vs. P_2 ($P<0.05$) and distinct significant differences between batches P_1 vs. P_3 ($P<0.01$) (tab. 1).

Normally, dry matter content recorded an increasing evolution, at the same time with increasing of slaughtering age. The calculated means were of 20.24±0.04% for batch P_1, 20.36±0.03% for batch P_2 and 20.42±0.04% for batch P_3. The studied character presented a very good homogeneity, a proof being the values of variation coefficient of 0.23-0.41%. Statistically speaking were recorded significant differences between batches P_1 vs. P_2 ($P<0.05$) and distinct significant differences between batches P_1 vs. P_3 ($P<0.01$) (tab. 1).

Regarding protein content in gizzards, batch P_1 recorded the highest level (17.28±0.02%), followed in a descendant order by batch P_2 (17.23±0.03%) and by batch P_3 (17.20±0.03%). The analysed parameter was homogenous, all the calculated values for variation coefficient being under the level of 10% (VC% = 0.28-0.40%). The differences between batches were without statistical significance ($P>0.05$) (tab. 1).

Regarding fat content, could be observed that this one suffered a low increasing, in parallel with increasing of slaughtering age. So, batch P_3 recorded the highest value, 1.34±0.02%, being followed by batch P_2 with a value of 1.30±0.01% and respectively by batch P_1 with a level of only 1.25±0.02%. The studied character was very homogenous inside each batch, its values being between 1.48 and 3.65%. From statistical analysis were observed significant differences between batches P_1 vs. P_2 ($P<0.05$) and distinct significant between batches P_1 vs. P_3 (tab. 1).

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Table 1 Chemical composition of gizzards provided from hybrid Ross 308

Quality parameters	Analysed batches (n=5)						ANOVA		
	P_1 (slaughtered at 35 days)		P_2 (slaughtered at 40 days)		P_3 (slaughtered at 42 days)				
	$\bar{X} \pm s_{\bar{x}}$	VC%	$\bar{X} \pm s_{\bar{x}}$	VC%	$\bar{X} \pm s_{\bar{x}}$	VC%	Compared batches	P value	Signification
Water (%)	79.76±0.04	0.10	79.64±0.03	0.10	79.55±0.02	0.06	P_1 vs. P_2	0.04487	* (P<0.05)
							P_2 vs. P_3	0.05409	ns (P>0.05)
							P_1 vs. P_3	0.00114	** (P<0.01)
Dry matter (%)	20.24±0.04	0.41	20.36±0.03	0.38	20.42±0.04	0.23	P_1 vs. P_2	0.04487	* (P<0.05)
							P_2 vs. P_3	0.05409	ns (P>0.05)
							P_1 vs. P_3	0.00114	** (P<0.01)
Proteins (%)	17.28±0.02	0.28	17.23±0.03	0.40	17.20±0.03	0.40	P_1 vs. P_2	0.25941	ns (P>0.05)
							P_2 vs. P_3	0.35654	ns (P>0.05)
							P_1 vs. P_3	0.08975	ns (P>0.05)
Fats (%)	1.25±0.02	3.65	1.30±0.01	1.48	1.34±0.02	2.36	P_1 vs. P_2	0.04028	* (P<0.05)
							P_2 vs. P_3	0.05081	ns (P>0.05)
							P_1 vs. P_3	0.00593	** (P<0.01)
Ash (%)	0.95±0.01	2.35	0.99±0.01	1.94	1.03±0.02	2.83	P_1 vs. P_2	0.01292	* (P<0.05)
							P_2 vs. P_3	0.04103	* (P<0.05)
							P_1 vs. P_3	0.00124	** (P<0.01)
NES (%)	0.76±0.01	1.98	0.83±0.02	2.99	0.87±0.02	4.09	P_1 vs. P_2	0.00300	** (P<0.01)
							P_2 vs. P_3	0.07366	ns (P>0.05)
							P_1 vs. P_3	0.00061	***(P<0.001)

ANOVA within rows, between groups for different superscripts, one by one comparison: ns = not significant (P>0.05); significant = * (P<0.05); distinguished significant = ** (P<0.01); highly significant = *** (P<0.001).

The effectuated analysis for identification of ash content in gizzard lead to obtaining of some values situated inside the interval 0.95±0.01% (gizzards gathered from hybrid Ross 308, slaughtered at 35 days) and 1.03±0.02% (gizzards gathered from hybrid Ross 308, slaughtered at 42 days). Even if the studied character was very homogenous inside those three batches (VC% = 1.94-2.83%), between them were recorded differences with statistical significance (P_1 vs. P_2, P<0.05; P_1 vs. P_3, P<0.01; P_1 vs. P_3 P<0.01) (tab. 1).

Gizzard content in non-nitrogenous extractive substances (NES) varied between a minimum of 0.76±0.01% (batch P_1) and a maximum of 0.87±0.02% (batch P_3). The values for variation coefficients were lower (VC% = 1.98-4.09%), which prove that this character had a very good homogeneity. Testing of statistical significance show distinct significant differences between batches P_1 vs. P_2 (P<0.01) and very significant between batches P_1 vs. P_3 (P<0.001) (tab. 1).

Calculus of energetic value presented the lowest value of only 87.97 kcal/100g for gizzards gathered from poultry slaughtered at 35 days (batch P_1), followed by gizzards of poultry slaughtered at 40 days (batch P_2) with 88.54 kcal/100g and the ones of poultry slaughtered at 42 days (batch P_3) with 82.92 kcal/100g (fig. 1).

The increasing of gizzards' energetic value with the increasing of slaughtering age could be explain by higher fat content existent in gizzards gathered from poultry with an advanced slaughtering age.

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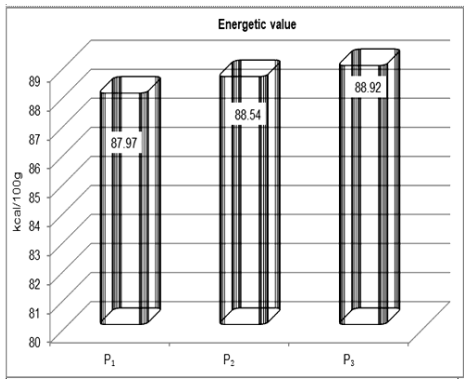

Fig. 1 Energetic value of gizzards gathered from hybrid Ross 308

• Chemical composition of hearts

The obtained results regarding water content of poultry hearts gathered from hybrid Ross 308 slaughtered at different ages show an increasing of this parameter at the same time with increasing of slaughtering age. So, the hearts gathered from poultry slaughtered at 35 days (batch I_1), had a water content of 78.12±0.06%, the ones gathered from poultry slaughtered at 40 days (batch I_2) of 77.99±0.06%, and the ones from poultry slaughtered at 42 days (batch I_3) of 77.94±0.04%. The studied character was very homogenous inside batches, the values of variation coefficient being inside interval 0.12-0.18%. Statistically speaking only in the case of batches I_1 vs. I_3 were recorded significant differences ($P<0.05$) (tab. 2).

Table 2 Chemical composition of hearts gathered from hybrid Ross 308

Quality parameters	Analysed batches (n=5)						ANOVA		
	I_1 (slaughtered at 35 days)		I_2 (slaughtered at 40 days)		I_3 (slaughtered at 42 days)				
	$\bar{X} \pm s_{\bar{x}}$	VC%	$\bar{X} \pm s_{\bar{x}}$	VC%	$\bar{X} \pm s_{\bar{x}}$	VC%	Compared batches	P value	Signification
Water (%)	78.12±0.06	0.16	77.99±0.06	0.18	77.94±0.04	0.12	I_1 vs. I_2	0.15489	ns (P>0.05)
							I_2 vs. I_3	0.55430	ns (P>0.05)
							I_1 vs. I_3	0.03564	* (P<0.05)
Dry matter (%)	21.88±0.06	0.57	22.01±0.06	0.62	22.06±0.04	0.43	I_1 vs. I_2	0.15489	ns (P>0.05)
							I_2 vs. I_3	0.55430	ns (P>0.05)
							I_1 vs. I_3	0.03564	* (P<0.05)
Proteins (%)	13.79±0.03	0.46	13.74±0.02	0.28	13.71±0.02	0.32	I_1 vs. I_2	0.12979	ns (P>0.05)
							I_2 vs. I_3	0.32766	ns (P>0.05)
							I_1 vs. I_3	0.42073	ns (P>0.05)
Fats (%)	4.32±0.03	1.40	4.40±0.02	1.01	4.44±0.01	0.75	I_1 vs. I_2	0.04889	* (P<0.05)
							I_2 vs. I_3	0.18561	ns (P>0.05)
							I_1 vs. I_3	0.00623	** (P<0.01)
Ash (%)	1,03±0,01	3,07	1.08±0.02	4.69	1.10±0.03	5.85	I_1 vs. I_2	0.07829	ns (P>0.05)
							I_2 vs. I_3	0.71209	ns (P>0.05)
							I_1 vs. I_3	0.06631	ns (P>0.05)
NES (%)	2.73±0.06	4.92	2.79±0.03	2.49	2.81±0.05	3.67	I_1 vs. I_2	0.44795	ns (P>0.05)
							I_2 vs. I_3	0.36945	ns (P>0.05)
							I_1 vs. I_3	0.75400	ns (P>0.05)

ANOVA within rows, between groups for different superscripts, one by one comparison: ns= not significant (P>0.05); significant =* (P<0.05); distinguished significant =** (P<0.01); highly significant =*** (P<0.001).

Proportionally dry matter content had an inversely variation being higher at hearts gathered from poultry slaughtered at 42 days (batch I_3) (22.06±0.04%) and lower at the

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ones gathered from poultry slaughtered at 35 days (batch I_1) (21.88±0.06%). Also were recorded significant differences only at the level of batches I_1 vs. I_3 ($P<0.05$), in conditions of a very good homogeneity of the studied characteristic (VC% = 0.43-0.62) (tab. 2).

Protein content presented values situated in interval 13.79% (batch I_1) and 13.71% (batch I_3), but without statistical significance between batches. The analysed parameter presented a profound homogeneity character, all the calculated values for variation coefficient being under the level of 10% (tab. 2).

Fat content varied very significant ($P<0.01$) with the increasing of slaughtering age from 4.32±0.03% (batch I_1) to 4.44±0.01% (batch I_3), while the hearts gathered from batch I_2 presented a value of 4.40±0.02%. The values for variation coefficient were inside interval 0.75-1.40%, fact which shown a very good homogeneity of the character inside each analysed batch (tab. 2).

Regarding ash content of poultry hearts, this one presented a minimum of 1.03±0.01% at batch I_1 and a maximum of 1.10±0.03% at batch I_2. The calculated variation coefficients for this parameter described the homogeneity of batches inside interval 3.07-5.85%. Analysing statistically the obtained data weren't recorded differences with statistical signification at the level of those 3 batches ($P>0.05$) (tab. 2).

After calculating the content in non-nitrogenous extractive substances (NES) of poultry hearts, batch I_1 recorded the lowest mean value of 2.73±0.06%, being followed by batch I_2 (2.79±0.03%) and by batch I_3 (2.81±0.05%). The values for variation coefficient (VC% = 2.49%-4.92%) show a very good homogeneity of the character inside experimental batches. The results of the statistical analysis realised between those 3 experimental batches shown differences but without statistical significance (tab. 2).

Increasing of lipid content, at the same time with increasing of slaughtering age leads also to increasing of energetic value (fig. 2).

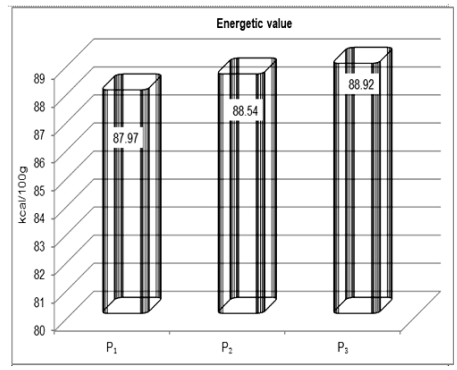

Fig. 2 Energetic value of hearts gathered from hybrid Ross 308

So, the minimum value of 108.47 kcal/100g was recorded at hearts gathered from poultry slaughtered at 35 days (batch I_1), and the maximum one of 109.45 at the ones gathered from poultry slaughtered at 42 days (batch I_3).

Even if the obtained results regarding chemical composition of poultry gizzard and heart are strictly relevant for the studied hybrid type, those values are close to the values obtained by other authors on other types of hybrids at different slaughtering ages (tab. 3).

Table 3 Comparison of chemical content with other published values

	Current study	Literature		
	42 days	Jokanović et al. (2014) [5]	Seong et al. (2015) [6]	Abdullah et al. (2016) [1]
Water				
Gizzard	79.55	81.50	79.94	78.60
Heart	77.94	73.10	77.36	74.82
Protein				
Gizzard	17.20	13.60	17.26	17.34
Heart	13.71	11.30	13.83	13.77
Fat				
Gizzard	1.34	1.50	0.81	0.76
Heart	4.44	12.50	4.53	6.97
Ash				
Gizzard	1.03	0.90	-	0.97
Heart	1.10	0.90	-	0.98

Some differences could be explained by genetic variations or by nutrition of the birds.

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CONCLUSIONS

The global analysis of chemical composition characteristic to those 2 analysed poultry edible organs (hearts and gizzards) show a high content in nutritive substances and a high energetic value.

The second important conclusion was that at the same time with the increasing of slaughtering age also increase the content in dry matter from poultry edible organs, in parallel with decreasing of water content.

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