

## EVOLUTION OF SOME PHYSICO-CHEMICAL AND MICROBIOLOGICAL PARAMETERS OF POULTRY GIZZARDS AND HEARTS STORED UNDER REFRIGERATION CONDITIONS

**Paula Viorela DRUC (GAFENCU)<sup>1</sup>, Carmen IRIMIA (GAVRILESCU)<sup>1</sup>, Cristian SPRIDON<sup>1</sup>,  
Marius Giorgi USTUROI<sup>1</sup>**

e-mail: paula.druc@yahoo.com

### Abstract

Nowadays, at worldwide a special attention is granted to the quality and safety of food products. In this context, the aim of the present study was to establish the maximum period of time that the poultry gizzards and hearts retains the minimum quality characteristics, so as to be accepted by consumers and at the same time not pose a threat to their health. The gizzards and hearts analyzed were packaged separately in polystyrene trays and stretch film and stored in a household refrigerator for 9 days at +3°C. In each day of storage, 5 packing units were opened for each assortment analyzed, from which samples were collected to evaluate the qualitative changes. The dynamic analysis of the pH of the studied gizzards and hearts highlighted slight increases in value from one control stage to another. Regarding easily hydrolysable nitrogen, by correlating the values obtained with the maximum limit imposed by the existing legislation (25 mg NH<sub>3</sub>/100g), it can be observed that by the 6th day of storage, the average values indicated a good product for consumption (23.34±1.55 mgNH<sub>3</sub>/100g for gizzards and 23.53±0.26 mgNH<sub>3</sub>/100g for hearts). The microbial load present in the poultry gizzards and hearts analyzed had an ascending evolution during the 9 days of control, both with respect the TNG and the number of germs from the genus Enterobacteriaceae, but variations in microbiological parameters fall within tolerance limits specified for them. Through the obtained results and considering the limits imposed by the existing standards, we can see that the 6th day of refrigeration storage is the maximum limit of the validation for the poultry gizzards and hearts.

**Key words:** (gizzards, hearts, refrigeration, quality)

Currently, a fundamental global prevalence is the prevention of illnesses through healthy eating.

Food security is of major importance for the meat industry. Chemical and microbial contamination of meat is a critical issue (Farag H., 2002).

Consumption of animal by-products has continued to show extraordinary growth over the last decade; due to their low cost, low fat content and the benefit of the short period of time required to prepare them (Alvarez-Astorga M. *et al*, 2002).

Bird organs are very perishable products. Depending on the degree of processing following slaughter, their spoilage varies between 4 and 10 days under refrigeration (Marenzi C., 1986).

The quality and safety of the bird organs is dependent on the processing and storage conditions (time period and insured physical factors), which is known in the fact that during the technological flow and during the storage period, in the food there are produced physico-chemical and

biochemical changes, which lead to a decrease in nutritional and hygienic quality.

Aerobic microorganisms can cause negative changes in the flavor, appearance, odor and consistency of the meat through their metabolic activity, and may also include pathogenic microorganisms that affect public health and lead to economic losses causing food damage.

Consumers have the right to expect that the food they buy and consume will be safe and of high quality.

In this context, the purpose of this study is to assess the stability over time of the indicators defining the quality of the gizzards and hearts and respectively, the identification of the threshold in which they undergo the refrigeration process and lose their freshness and pass to the deterioration state.

### MATERIAL AND METHOD

The studied material was represented by gizzards and hearts resulted from the Ross hybrid.

<sup>1</sup> “Ion Ionescu de la Brad” University of Agricultural Sciences and Veterinary Medicine, Iași

The samples studied were purchased from a local manufacturer and analyzed on the day of collection before being refrigerated (registered as day 0). To assess the stability of the gizzards and hearts during storage under refrigeration conditions, the studied organs were packed in polystyrene and stretch film trays and stored in a household refrigerator for 9 days at + 3°C. At the end of the first day of storage, 5 units of packaging were opened for each analyzed organ, from which samples were taken to assess their qualitative changes. This process was repeated on a daily basis until the 9<sup>th</sup> day of storage, in order to monitor the qualitative changes of the gizzards and hearts, that occurred also after the expiration date specified by the manufacturer (maximum 6 days).

To assess the daily quality of gizzards and bird hearts, physico-chemical indicators (pH value, easily hydrolyzable nitrogen) and microbiological (total number of germs, *Enterobacteriaceae*) were proposed for examination.

The pH value was determined with the help of a pH meter InoLab (SR ISO 2917: 2007); the readily hydrolyzable nitrogen was identified according to the method specified in SR 9065-7: 2007. The microbiological indicators were analyzed

as follows: TNG was determined on a standard plate, PCA medium at 37°C for 72 hours (SR ISO 4833-1: 2003), and the number of *Enterobacteriaceae* was determined on a VRBG medium for 24 hours at 37°C (SR ISO 21528-2: 2007).

## RESULTS AND DISCUSSION

PH value, it is a particularly important quality indicator because it can be correlated with implicitly microbiological sensory indicators.

Analysis of the pH value of the studied gizzards samples showed a slight increase in value from one control day to another. Thus, if the control on the first day of storage, the mean value of the pH was  $6.30 \pm 0.01$ , on the 6<sup>th</sup> control day (the expiration date set by the manufacturer) it reached an average of  $6.92 \pm 0.01$ , while on day 9 it had the value of  $7.36 \pm 0.01$ . Regarding the value of the coefficient of variation for each control step, it can be mentioned that it was presented as a very homogeneous character ( $V\% < 10$ ) (table 1).

Table 1

The dynamics of physico-chemical indicators of poultry gizzards (n=10)

Storage life (days)	pH value				Easily hydrolysable nitrogen (mgNH <sub>3</sub> /100g)			
	$\bar{X} \pm s \bar{x}$	V%	Min.	Max.	$\bar{X} \pm s \bar{x}$	1.90	Min.	Max.
0	$6.30 \pm 0.01$	0.34	6.27	6.37	$11.88 \pm 0.07$	1.21	6.34	6.47
1	$6.32 \pm 0.01$	0.50	6.28	6.38	$12.46 \pm 0.05$	3.17	6.37	6.54
2	$6.41 \pm 0.01$	0.31	6.37	6.43	$13.96 \pm 3.17$	2.45	6.41	6.58
3	$6.51 \pm 0.01$	0.56	6.47	6.47	$15.11 \pm 2.45$	1.50	6.52	6.69
4	$6.63 \pm 0.01$	0.51	6.59	6.68	$18.18 \pm 1.49$	1.74	6.64	6.85
5	$6.79 \pm 0.02$	0.91	6.71	6.88	$21.21 \pm 1.74$	1.55	6.73	6.96
6	$6.92 \pm 0.01$	0.32	6.89	6.95	$23.34 \pm 1.55$	1.35	7.10	7.22
7	$7.12 \pm 0.01$	0.24	7.10	7.15	$25.31 \pm 1.35$	1.83	7.27	7.43
8	$7.26 \pm 0.01$	0.37	7.20	7.29	$26.86 \pm 1.83$	0.63	7.32	7.55
9	$7.36 \pm 0.01$	0.34	7.32	7.40	$28.97 \pm 0.63$	1.90	7.57	7.68

The obtained results indicated that the value of the slightly hydrolyzable nitrogen in the studied gizzards increased quantitatively during storage under the applied refrigeration conditions.

By correlating the values obtained with the maximum limit imposed by the legislation in force (\*\*\*) 2002) of 25 mgNH<sub>3</sub>/100g it can be seen that by the 6<sup>th</sup> day of storage, the mean values of ammonium nitrogen content indicated that the product is good for consumption; on the 7<sup>th</sup> of control, the upper limit of slightly hydrolyzable nitrogen content was exceeded (as a result of triggering of the alteration process), recording the value of  $25.31 \pm 1.35$  mgNH<sub>3</sub>/100g.

The values calculated for the coefficient of variation were in the range of 0.63-3.17%, which

indicates a uniformity of character over the entire control period.

Regarding the TNG in the analyzed gizzards samples, it recorded values that increased from one day to another. Thus, if the microbiological control performed on day 1 recorded a value of  $4.93 \pm 0.01$  log<sub>10</sub>cfu/g, at control on the last day of validity (day 6) it reached a level of  $5.02 \pm 0.01$  log<sub>10</sub>cfu/g, while at the last control (day 9), the average number of aerobic mesophilic germs was  $6.00 \pm 0.02$  log<sub>10</sub>cfu/g. The coefficients of variation showed very low values throughout the control period ( $V\% = 0.15-0.97$ ), which allowed us to characterize this character as very homogeneous (table 2).

Table 2

The dynamics of microbiological indicators of poultry gizzards (n=5)

Storage life (days)	TNG (log <sub>10</sub> cfu/g)				Enterobacteriaceae (log <sub>10</sub> cfu/g)			
	$\bar{x} \pm s \bar{x}$	V%	Min	Max	$\bar{x} \pm s \bar{x}$	V%	Min	Max
0	4.96±0.02	0.70	4.90	4.99	1.83±0.01	0.68	1.81	1.85
1	4.97±0.01	0.35	4.96	4.99	1.84±0.01	0.72	1.83	1.86
2	4.99±0.01	0.33	4.97	5.01	1.85±0.01	0.87	1.83	1.87
3	5.00±0.01	0.23	4.99	5.02	1.85±0.01	0.69	1.84	1.87
4	5.01±0.01	0.21	5.00	5.02	1.86±0.01	0.73	1.85	1.88
5	5.02±0.01	0.15	5.01	5.03	1.93±0.02	2.51	1.88	1.99
6	5.03±0.01	0.17	5.02	5.04	1.96±0.02	1.84	1.91	1.99
7	5.12±0.02	0.97	5.06	5.17	2.28±0.03	2.82	2.17	2.32
8	5.48±0.02	0.95	5.41	5.55	2.97±0.02	1.53	2.90	3.00
9	6.00±0.02	0.81	5.98	6.04	3.03±0.03	1.85	3.00	3.13

Regarding the number of germs of the genus *Enterobacteriaceae* recorded on the first day of storage, the value was 1.83±0.01 log<sub>10</sub>cfu/g, whereas on the day of expiry set by the manufacturer (day 6) reached 1.86±0.01 log<sub>10</sub>cfu/g. The studied character was very homogeneous within the groups during the analyzed period (V% = 0.68-2.82).

The pH value analysis of the bird hearts in the study highlighted the value increases that went along with the aging of the product. Thus, it can be seen that in the case of hearts stored for one day under refrigeration conditions, the mean value of the pH was 6.39±0.01, while on day 6 the control

value was 7.16±0.01. The parameter analyzed has kept its homogeneity, all values calculated for the coefficient of variability being below the 10% threshold.

The obtained results indicated that slightly hydrolyzable nitrogen in the poultry hearts increased quantitatively during storage under refrigeration conditions, registering on day 7 a value of 25.53±0.12 mgNH<sub>3</sub>/100g; value greater than the maximum limit imposed by the legislation in force (25 mgNH<sub>3</sub>/100g). The studied character was homogeneous for the entire analyzed period, its values ranging from 0.55-3.48% (table 3).

Table 3

The dynamics of physico-chemical indicators of poultry hearts (n=10)

Storage life (days)	pH value				Easily hydrolysable nitrogen (mgNH <sub>3</sub> /100g)			
	$\bar{x} \pm s \bar{x}$	V%	Min.	Max.	$\bar{x} \pm s \bar{x}$	V%	Min.	Max.
0	6.39±0.01	0.67	6.34	6.47	12.09±0.12	3.03	11.61	12.58
1	6.44±0.02	0.85	6.37	6.54	12.43±0.10	2.55	11.98	12.89
2	6.50±0.02	0.92	6.41	6.58	13.88±0.08	1.82	13.47	14.28
3	6.58±0.02	0.79	6.52	6.69	15.13±0.13	2.72	14.91	15.92
4	6.71±0.02	1.02	6.64	6.85	18.22±0.16	2.78	17.51	18.94
5	6.86±0.02	0.96	6.73	6.96	21.44±0.15	1.22	20.76	22.05
6	7.16±0.01	0.54	7.10	7.22	23.53±0.26	3.48	22.23	24.79
7	7.35±0.02	0.82	7.27	7.43	25.53±0.12	1.47	24.89	26.09
8	7.47±0.02	0.97	7.32	7.55	27.10±0.13	1.47	26.64	27.87
9	7.59±0.02	0.87	7.57	7.68	29.06±0.12	0.55	28.71	29.22

The microbiological examination of poultry hearts during the 9 days of storage showed an increasing evolution of TNG from day to day control (from 3.57±0.01 log<sub>10</sub>cfu/g, (day 1) to 4.78±0.05 log<sub>10</sub>cfu/g (day 9).

The microbiological indicator analyzed has kept its homogeneity, all the values calculated for

the coefficient of variability being below the 10% (V% = 1.58-2.96) (table 4).

Following the study, it can be observed that TNG recorded in gizzards and bird hearts presented within 6 days of control values below the maximum admissible limits; below the level of 1x10<sup>6</sup> ufc/g (6.0 log<sub>10</sub>cfu/g) (\*\*\*)2010).

Table 4

The dynamics of microbiological indicators of poultry hearts (n=5)

Storage life (days)	TNG (log <sub>10</sub> cfu/g)				Enterobacteriaceae (log <sub>10</sub> cfu/g)			
	$\bar{X} \pm s\bar{x}$	V%	Min	Max	$\bar{X} \pm s\bar{x}$	V%	Min	Max
0	3.57±0.01	0.20	3.56	3.58	1.77±0.01	0.96	1.75	1.79
1	3.58±0.02	1.15	3.56	3.66	1.78±0.01	1.03	1.76	1.80
2	3.59±0.02	1.11	3.57	3.66	1.80±0.01	1.47	1.76	1.82
3	3.61±0.02	1.06	3.57	3.67	1.82±0.01	0.71	1.80	1.83
4	3.63±0.02	0.92	3.61	3.69	1.83±0.01	0.69	1.81	1.85
5	3.64±0.02	1.01	3.61	3.85	1.84±0.01	1.12	1.82	1.87
6	3.77±0.05	2.88	3.63	3.90	1.88±0.03	3.66	1.85	2.00
7	3.85±0.03	1.56	3.80	3.93	1.95±0.01	1.70	1.92	2.00
8	4.09±0.04	2.36	4.02	4.24	2.26±0.05	4.63	2.14	2.39
9	4.78±0.05	2.43	4.66	4.95	2.88±0.04	2.78	2.78	3.00

Following the analysis of the total bacteria of the *Enterobacteriaceae* species existing in the bird's heart, an increase in the microbial load was observed from 1.77±0.01 log<sub>10</sub>cfu/g, the value obtained on the first day of storage to 1.88±0.03 log<sub>10</sub>cfu/g (day 6) and 2.88±0.04 log<sub>10</sub>cfu/g (day 9). The values of the coefficient of variation (V% = 0.69-4.63%) indicate good homogeneity for this parameter.

### CONCLUSIONS

Through the obtained results and considering the limits imposed by the existing standards, we can see that the 6th day of refrigeration storage is the maximum limit of the validation for the poultry gizzards and hearts.

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