

ABSTRACT

Key words: bird edible organs, quality, refrigeration, storage

The research realised for elaboration of PhD thesis entitle “*Contributions to knowledge of birds’ edible organs quality*” have targeted to realisation of an ensemble image on nutritive value of some foodstuff products which are appreciated by consumers, but less studied by specialists, respectively birds’ edible organs.

The aim of research was motivated by the fact that, nowadays, legislation doesn’t stipulate quality criteria and classes for bird liver, gizzard and heart.

Another motivation for the realised studies was that birds’ edible organs have a low priority for research both in Romania as well as at world level (were founded very few information regarding quality of birds’ edible organs).

So, into current research were realised 3 experiences, difference being represented by the product type (bird edible organ) on which was realised specific determinations.

Each of those 3 experiences aimed two major aspects: qualitative characterization of analysed product and respectively appreciation of its stability during storage in refrigeration conditions.

The experimental variables were represented by the hybrid type from which the studied edible organs were gathered and birds’ slaughtering age.

Those three categories of products were achieved from specialised units in the day in which birds were slaughtered and transported in adequate conditions (freezer boxes) at laboratories where were realised the specific determinations (sensorial, physical-chemical and microbiological).

In this way, for each of those 3 experiences were made 4 batches, with different codes, function of provenance, as follows:

- Experience 1. “*Results regarding quality of bird liver*”

F₁ = liver gathered from hybrid “ROSS 308”, slaughtered at age of 35 days;
F₂ = liver gathered from hybrid “ROSS 308”, slaughtered at age of 42 days;
F₃ = liver gathered from hybrid “COBB 500”, slaughtered at age of 35 days;
F₄ = liver gathered from hybrid “COBB 500”, slaughtered at age of 42 days.

- Experience 2. “*Results regarding quality of bird gizzards*”

P₁ = gizzards gathered from hybrid “ROSS 308”, slaughtered at age of 35 days;
P₂ = gizzards gathered from hybrid “ROSS 308”, slaughtered at age of 42 days;
P₃ = gizzards gathered from hybrid “COBB 500”, slaughtered at age of 35 days;
P₄ = gizzards gathered from hybrid “COBB 500”, slaughtered at age of 42 days.

- Experience 3. “Results regarding quality of bird hearts”

I₁ = hearts gathered from hybrid “ROSS 308”, slaughtered at age of 35 days;

I₂ = hearts gathered from hybrid “ROSS 308”, slaughtered at age of 42 days;

I₃ = hearts gathered from hybrid “COBB 500”, slaughtered at age of 35 days;

I₄ = hearts gathered from hybrid “COBB 500”, slaughtered at age of 42 days.

To achieve the second desideratum of our research, respectively appreciation of birds’ edible organs stability during storage, it has been agreed that all those 3 studied edible organs to be identically packed (polystyrene trays and stretch foil) and kept in according with the recommendations of producer (at 0...+4°C).

At the end of first day of storage we open one packing unit from which were gathered 5 samples for evaluation of qualitative modifications at analysed products. This procedure was daily repeated till day 9 of storage to observe the qualitative modifications of organs also after expiration of shelf lifetime, respectively maximum 6 days.

Evaluation of storage stability for bird edible organs was realised through the same quality indicators (sensorial, physical-chemical and microbiological). We mention the fact that was kept the initial experimental variables (hybrid type and slaughtering age).

1. At the end of realised research regarding *evaluation of bird liver quality* gathered from hybrids “ROSS 308” and “COBB 500”, which were slaughtered at different ages (35 and 42 days) were observed the following aspects:

Sensorial exams didn’t indicate any modification, the obtained score being maximum (20 points) for all those 4 analysed batches.

Mean weight of liver for studied broiler chicken was 44.20 g.

pH value of liver wasn’t influenced by the provenance hybrid nor by the slaughtering age of it; the established mean value was 6.18.

Regarding chemical composition of bird liver, this one wasn’t influenced by the hybrid type nor by slaughtering age, with the exception of water content (which recorded a descendant evolution with birds’ aging) and lipids (presented a light increase, at the same time with increasing of slaughtering age).

Water mean content in broiler chicken liver was 76.49%, and the one for dry matter was 23.51%.

Mean values of proteins in broiler chicken liver was 17.55%, while mean value of amino acids was 33.74 mg/100g.

Fat mean content in broiler chicken liver was 3.59%.

Regarding fatty acids content, mean value of identified saturated fatty acids was 37.67 g/100g, and the one for content in monounsaturated fatty acids was 19.51 g/100g, for content of polyunsaturated fatty acids the obtained value was 42.26 g/100g.

Regarding mineral substances, the mean value for iron content established in broiler chicken liver was 8.38 mg/100g, for calcium was 7.93 mg/100g, and the one for magnesium was 20.59 mg/100g.

By calculation of energetic value was established that mean energetic value of liver was 111.46 kcal/100g.

Microbiological indicators weren't influenced by hybrid type and slaughtering age; mean value identified for TNG was 3.39 log₁₀cfu/g, for *Enterobacteriaceae* was 1.68 log₁₀cfu/g; we mention that pathogen species *Escherichia coli* and *Salmonella* spp. were absent.

The obtained data regarding contamination with heavy metals indicated that at all analysed liver samples values were under the tolerance level. Lead mean value was 0.04 mg/kg, and for cadmium was obtained a value of 0.0087 mg/kg.

Regarding stability of bird liver during storage in refrigeration conditions we could affirm that:

Bird liver analysed for all those 4 batches presented features characteristic to relatively fresh liver starting from day 4 and 5 of storage; in day 6 of storage such a product was classified as "satisfactory".

Analysis in dynamics for pH value of studied liver revealed value increases which were in parallel in product aging.

Liver content in easily hydrolysable nitrogen recorded an increased evolution during whole control period. At the expiration of shelf lifetime, nitrogen levels presented a mean value (22.23 mg NH₃/100g), situated under the superior limit, legally allowed for bird liver.

Regarding the presence of sulphurs hydrogen, the obtained results indicated that chicken liver kept its freshness during 5 storage days; also Kreis reaction was negative in the first 5 days.

Chemically speaking was observed a light decreasing tendency for water content, in relation with increasing of dry matter content; proteins level presented light increases of values, while lipids' content decreased with prolongation of storage period. Also, value of content in total mineral substances, the one of non-nitrogenous extractive substances and respectively energetic value presented ascendant values at each studied batch.

Microbiological analysis highlighted a significant ascendant evolution, regarding TNG and number of germs belonging to *Enterobacteriaceae* family (the obtained values being lower than the limits stipulated in the actual legislation), and also indicated the absence of pathogen bacteria *Escherichia coli* and *Salmonella* spp.

2. Studies effectuated regarding evaluation of bird gizzards quality gathered from hybrids "ROSS 308" and "COBB 500", with slaughtering at different ages (35 and 42 days) revealed that:

Sensorial speaking was observed that analysed bird gizzards obtained a maximum total score (20 points).

Mean weight of gizzard for studied broiler chicken was 24.06 g.

pH value of gizzard wasn't influenced by the experimental factors; the established mean value was 6.30.

Regarding chemical composition of bird gizzard, were observed light differences generated by the provenance hybrid and by slaughtering age of broiler chicken. Mean water content of bird gizzards was 79.57%, while mean value for dry matter reached a level of 20.43%.

Mean value of proteins from broiler chicken gizzard was 17.27%, and determination of essential amino acids indicated a mean value of 33.93 g/100g.

Fat mean content in broiler chicken gizzard was 1.33%, while dosage of fatty acids highlighted a mean value of 38.53 g/100g saturated; 34.73 g/100g monounsaturated and 25.13 g/100g for polyunsaturated ones.

Regarding mineral substances content was noticed that mean value for iron content established in broiler chicken gizzard was 1.77 mg/100g, for calcium was 11.14 mg/100g, and the one for magnesium was 16.17 mg/100g.

Mean level of energetic value established for studied was broiler chicken gizzards 89.05 kcal/100g.

Regarding microbiological parameters was observed that in case of TNG mean value identified in gizzards was 4.96 log₁₀cfu/g, and mean value established for bacteria belonging to *Enterobacteriaceae* family was 1.830 log₁₀cfu/g; species from genus *Escherichia coli* and *Salmonella* spp., being absent.

Regarding appreciation of stability of bird gizzards during storage period in refrigeration regime were highlighted the following aspects:

After sensorial analysis was observed a qualitative deterioration of bird gizzards with storage period, from a mean score of 20.0 points recorded in day 1 till 7.70 points obtained in the last control day.

Data regarding pH value indicated an increase of it during those 9 storage days.

Regarding easily hydrolysable hydrogen, evolution of it had a continuous degradation, during storage period of studied bird gizzards.

Sulphurs hydrogen indicated a light presence of it starting with day 7 of storage (3 samples light positive from 5 at batches P₃ and P₄ respectively, 4 samples light positive from 5 at batches P₁ and P₂).

Regarding Kreis reaction, this one was negative for 5 days, after that became weak positive in days 6 and 7 and positive in days 8 and 9.

Chemical composition was evaluated in connection with water content, which decreases at the same time with prolongation of storage time in parallel with the increases recorded by dry matter. Proteins presented a light ascendant evolution (at the same time with the increasing of dry matter) with mean values between 17.24% in first day and 17.50% in last day, while lipids level decreased from 1.32% (recorded in first day) to 0.95% (in day 9).

Energetic value of broiler chicken gizzards presented a light decrease from one control stage to another at all those 4 analysed batches.

Determination of TNG and *Enterobacteriaceae* shown increases from one control day to another, but microbiological variations were between tolerance limits. Also, microbiological analysis had shown the absence of bacteria *Escherichia coli*, as well as the lack of the ones belonging to *Salmonella* spp. genus.

3. Research effectuated regarding evaluation of bird hearts quality obtained from hybrids “ROSS 308” and “COBB 500”, with slaughtering at different ages (35 and 42 days) shown that:

Qualitatively speaking, the total score obtained at the end of sensorial evaluation was maximum (20 points).

Mean weight of hearts for studied broiler chicken was 7.10 g.

Regarding pH value in hearts was observed that this one wasn't influenced by provenance hybrid nor by its slaughtering age; the established mean value for broiler chicken hearts 6.40.

Analysis of chemical content for bird hearts had shown the fact that wasn't influenced by the applied experimental factors. Mean water content of broiler chicken hearts was 78.02%, in parallel mean value for dry matter identified in broiler chicken hearts was 21.99%.

Mean value of proteins was 13.77%, and the one for essential amino acids identified in broiler chicken hearts was 30.05 g/100g.

Mean of fat content in broiler chicken hearts was 4.29%, and regarding content in fatty acids, mean value for content in saturated fatty acids was 28.57 g/100g, the one for content in monounsaturated fatty acids was 35.27 g/100g, and for content in polyunsaturated fatty acids the obtained value was 34.74 g/100g.

From the obtained data it was also observed that mean value for iron content established for broiler chicken hearts was 3.53 mg/100g, for calcium was 10.65 mg/100g, and the one for magnesium was 16.66 mg/100g.

Energetic value established for broiler chicken hearts was 108.48 kcal/100g.

Microbiologically speaking, was observed that TNG and bacteria *Enterobacteriaceae* presented values under the maximum allowed by actual legislation, and bacteria *Escherichia coli* and *Salmonella* spp. were absent. Mean value identified for TGN in broiler chicken hearts was 3.56 log₁₀cfu/g, while mean value established for *Enterobacteriaceae* was 1.83 log₁₀cfu/g.

Mean value for lead in broiler chicken heart was 0.29 mg/kg, and the one for cadmium was 0.02 mg/kg.

Research regarding appreciation of stability of bird hearts during storage in refrigeration regime shows the followings:

Regarding sensorial quality birds' hearts presented features characteristic to a fresh product for 4 days from storage and relatively fresh in day 5 and 6; being declared improper for consumption starting with day 7.

Value of pH indicated an increase during storage period from 6.44 (mean value recorded in first day) till 7.54 (day 9).

Determination of easily hydrolysable hydrogen revealed a continuous increase of it during whole control period. At expiration of shelf lifetime, nitrogen levels presented a mean value of 23.37 mg NH₃/100g, below superior limit, legally permitted for bird meat.

Presence of sulphurous hydrogen was noticed starting with day 7 (2 samples lightly positive from 5 at batches I₁ and I₃ and 3 samples lightly positive from 5 at batches I₂ and I₄).

As regarding Kreis reaction, this one was negative for 5 days, after that became weak positive in days 6 and 7 and positive in days 8 and 9.

Chemical analysis show the fact that during storage took place light decreasing of water content in parallel with the increasing of dry matter content.

Results regarding protein content indicated lightly increases from 13.78% (day 1) to 13.99% (day 9).

Regarding fat content, we could say that the rate contained by analysed hearts had a descendant trend from one control storage to another, aspect also observed for energetic value at all those 4 analysed batches.

Refrigeration time and temperature influenced the development of TNG and bacteria *Enterobacteriaceae*, so were observed daily increases, but the recorded values corresponded microbiologically in all those 9 control days.

Also in case of hearts weren't observed pathogen bacteria *Escherichia coli* and *Salmonella spp.* at any control stage.

Based on the obtained results we propose the following recommendations:

✓ Edible by-products obtained after slaughtering of hen broiler chicken, respectively: liver, gizzard and heart present valuable sensorial, physical-chemical and microbiological features, being an important protein source with a high biological value, very important for human nourishment.

✓ It is recommended the consumption of those organs in fresh state, but if it is necessary to preserve them, must be mandatory their preservation by refrigeration at a temperature of 0...+4°C, in cold storages and well aerated. But, after 4-5 days of refrigeration in this conditions start the degradation processes of analysed organs, which make them improper for consumption.