PhD DISSERTATION ABSTRACT

It is known that nutrition quality, consequently the nutrients level and quality in food, is a main influential factor of the consumers' health status. Thus, the food industry should consider all possible ways to improve nutritional value of aliments. Despite this, the data related to some quality indexes of the poultry meat, that could contribute to establish an overall image of the nutritional and dietetic facts of this product are poorly represented in the scientific literature, mainly when the consumer might be interested by the meat produced and commercialised nowadays in Romania.

Consequently to the bibliographical study, a series of ideas have been briefed

1. Poultry meat, as an animal origin product with a high biological value could be found on the 2nd place worldwide, as consumers preferences;

2. Till now, the aviculture researches, concerning the poultry meat production, mainly focused on the quantitative side of this production, through the breeding and marketing of some valuable genotypes, which allow the high valorisation of feed, providing high financial revenue in a short time period;

3. During the last years, simultaneously with the introduction of the food quality management systems, several studies concerning meat quality have been deployed;

4. Besides this, it imposed to organise some studies related to certain qualitative features of the skeletal muscles issued from chicken broilers (histological and physical-chemical properties), knowing that the technical specifications of the companies producing hybrids do not issue about them, mainly focusing on the quantitative meat yield parameters.

The original own researches have been organised in two experimental series, as a transversal type study, which had as main goal the analysis of the quantitative and qualitative meat production at two of the most used commercial chicken hybrids in our country - „COBB-500" (60 chickens, sex ratio 1:1) and „ROSS-308" (60 chickens, sex ratio 1:1), reared in similar technological conditions.

The quantitative meat production has been assessed by several parameters:

- live weight and carcasses weight, slaughtering efficiency;
- participation of the trenched parts and of some muscles (superficial and profound pectorals, arm biceps, semimembranous, medial shank twin) in carcass structure.

Meat quality was evaluated through several parameters:

- histometry;
- physical features (pH value);
- chemical composition (water, DM, proteins, amino acids, lipids, cholesterol, fatty acids);
- caloricity.

Meat yield has been studied through gravimetry and mathematical methods:

➲ *gravimetric methods*: carcasses weighting; trenched parts weighting; sampled muscles weighting.

➲ *data interpretation methods*:

- o algebraic methods (computations of various ratios);
- o statistical methods (average, variance, standard deviation, standard mean error, variation coefficient and ANOVA single factor algorithm for analysis of variance).
- o comparisons between experimental and references data

Meat quality has been assessed by specific methods, as it follows:

a. Histological quality:

➲ *sampling and preserving methods*: necropsy; sampling and labelling; fixation in formic aldehyde.

➲ *processing of histological samples:* paraffin sectioning technique; smears coloration with HEA mixture.

➲ *histological smears investigation methods:*

- o optical devices calibration (microscope, microcamera);
- o micrometric measurements within microscopic field:
  - muscular fibers diameters ;
  - diameters of the 1st and 2nd order muscular fascicles.
- o counting within the microscopic field:
  - Counting of muscular fibers within the 1st order muscular fascicles;

➲ *mathematical computation methods applied to interpret primary data*:

- o algebraically methods:
  - computation of the mean myocites diameter;
  - computation of the cross-section areas of the fibers;
  - computation of the cross-section areas of the 1st order muscular fascicles;
  - computation of the muscular fibers density;
  - computation of the participation ratio of main tissue categories in muscles structure.
  -

- *data interpretation methods*:
  - statistical methods;
  - correlation of the histological structure data with several sensorial properties of the meat (tenderness, texture etc.)
  - Comparisons between experimental and references data

b. Physical features of the studied muscles *have been assessed through**:***

- *pH measurements using a digital pH-meter;*
- *data interpretation methods*:
  - statistical methods;
  - comparisons between experimental and references data

c. *Chemical composition and nutritional values of the studied muscles:*

- *methods used in chemical composition assessments:*
  - drying oven method, used for dry matter and water content;
  - calcination method, used for ashes assessments;
  - organic matter proportion – through computation;
  - Kjeldahl method, for protein content;
  - Soxhlet method, for eterate extract assessment (lipids content);
  - Free nitrogen extract – through computation.
  - Liquid chromatography (HPLC) for amino acids content;
  - Gaseous chromatography, for fatty acids and cholesterol content
- *Methods used for caloricity estimation:*
  - Estimation of the gross energy, basing on the chemical composition – regression equations.
- *data interpretation methods*:
  - statistical methods;
  - comparisons between experimental and references data

Consequently to the original researches, a series of conclusions issued, related to the rearing performances of the chickens, to the efficiency of the feed conversion, to some aspects concerning quantitative meat production (slaughtering efficiency, participation of trenched parts in whole carcass structure), as well as to some features dealing with the studied muscles morphology and with meat quality, as it follows:

- the "COBB-500" chickens reached, prior to slaughter (42 days), an **average liv weight of** 2.45 Kg. This performance has been achieved through an individual **average feed intake** of 4.68 Kg, meaning a value of 1.91 Kg feed/Kg gain **FCR**, as compared to 1.78 Kg feed/Kg gain, value recommended by the hybrid producer.;

- the „ROSS-308" broilers reached, at slaughtering age (42 days), an **average body weight** of 2.39 Kg. This performance has been achieved through a mean feed intake of 4.48 Kg, consequently through a 1.91 value for the **FCR**, higher than that specified by the hybrid producer (1.75 Kg feed/Kg gain);
- **flock losses**, during the entire experimental period, when "COBB-500" has been used, reached 191 chicks, meaning 2.05% losses from the entire flock (9500 broilers);
- for the second studied hybrid, "ROSS-308", flock looses, cumulated for the entire 42 days period, reached 199 broilers, meaning 2.03% losses from the whole flock of 10000 chickens;
- **slaughtering efficiency**, calculated on fresh carcasses, has been found, for both genders, of 78.94±0.35%, while after carcasses have been refrigerated, it reached 77.76±0.35% ("COBB-500");
- slaughtering efficiency, calculated right after slaughter, reached in both genders 79.56%, while, after refrigeration, it was calculated at 78.40% ("ROSS-308");
- the **participation of trenched parts in the whole carcass structure** of the "COBB-500" broilers reached the following values: 29.66±0.13% for breast with bone and skin; 8.98±0.09% for wings; 15.71±0.21% for thighs; 13.33±0.13% for shanks and 32.33±0.27% for the remnants (heat, neck, back and legs);
- in "ROSS-308" hybrids, the values for the same characters are listed below: 29.20% for breast with skin and bones; 9.11% for wings; 16.31% for thighs; 13.32% for shanks and 31.84% for the other parts (heat, neck, back and legs);
- **breast fillet** (deboned breast – superficial and profound pectoral muscles) represented 23,2% from the carcass weight of "COBB-500" broilers (both genders);
- meat from breast (superficial and profound pectoral muscles) represented 23,09% from the whole carcass weight of the "ROSS-308" broilers;
- the study on the **dimensional elements of the muscular fibers** revealed certain aspects: in "COBB 500" broiler, the muscles with the thickest fibers were the profound pectorals from males (41.11±0.56µ), while the thinnest myocytes have been observed within the *Biceps brachialis* muscles, mainly in those sampled from pullets (26.51±0.34µ). The myocytes shape on cross-section area was ellipsoid, the average DM/Dm ratio values varying within the 1.25/1 … 1.44/1 interval;
- for the second studied hybrid ("ROSS-308") the muscles with the thickest fibers were the superficial pectorals, from pullets (54.8µ), while the thinnest fibers were found in *Biceps brachialis* muscles (30.8µ, in females). The shape on cross-section has also been ellipsoid;
- within the pectoral profound muscle, issued from the "COBB-500" broilers, the **myocytes density** was the poorest (407.51±18.18 f.m./mm^2), while the highest agglomeration of

muscular fibers has been calculated for the *Biceps brachialis* muscles, issued from the pullets (1061.94±47.72 f.m./mm^2);

- the lowest density in the "ROSS-308" muscles has been found in cockerels superficial pectorals (287.81 f.m./mm^2), while the highest one within the *Biceps brachialis*, sampled from pullets (829.05 f.m./mm^2);
- in "COBB-500" hybrid, the males superficial pectorals comprised the highest **proportion of pure muscular tissue** (65.22%), while the *Biceps brachialis* ones had the lowest one (50.43%). In females, the highest proportion of muscular tissue was found in the profound pectorals (62.56%) while the poorest one in the superficial pectorals (56.12%);
- at the second studied broiler ("ROSS-308"), the males superficial pectoral muscles had the richest proportion of muscular tissue (62.52%), while the poorest one has been measured within the thighs muscles (57.3%). In females, the highest proportion of muscular tissue was found in the profound pectorals, (68.57%), while the lowest has been observed within the *Semimembranosus* ones (55.72%);
- the highest initial **pH value** in the samples issued from the "COBB-500" broilers has been measured in females superficial pectorals (6.34), while the minimal one was observed in the males *Gastocnemius medialis* muscles (5.92). **After 24 hours**, the value for this parameter was found between the 5.76...6.03 limits;
- within the samples issued during the 2nd experimental series, ("ROSS-308" broilers), the highest pH value was measured in thighs muscles at males (6.61), while the lowes one was found in the cockerels superficial pectorals (5.97). At 24 hours post-slaughter, this parameter was measured within the 5.87...6.61 interval;
- for both studied hybrids, it was observed that the males pectoral muscles comprise a higher quantity of **dry matter**, compared to the pullets; when the wings, thighs and shanks muscles are analyzed, the ratio presents conversely;
- **the lipids** constituted the compound with the highest variation amplitude between the muscles studied in both hybrids: in "COBB 500" chickens, the minimal value (1.12%) was observed in the cockerels superficial pectorals and in the pullets profound pectorals, while the maximal one (9.24%) was found in the females thighs muscles; almost a similarly situation occurred for the "ROSS-308" broilers, but with a wider variation interval, meaning a minimum of 0.95% (superficial pectorals in males) and a maximum of 9.92% (in females);
- meat **cholesterol** content varied within the 56 mg/100g (breast muscles) – 83 mg/100 g (thigh muscles) interval for the samples issued from "COBB-500" hybrids, respectively between the minimal value of 57 mg/100g and the maximal one of 83 mg/100 g, in the samples taken from the "ROSS-308" chickens;

- the ratio between **polyunsaturated and saturated fatty acids** in "COBB-500" muscles has been calculated at 1.06:1 (profound pectorals), respectively at 0.79:1 (shanks muscles); for the "ROSS-308" chickens, the ratio proved to be better in the profound pectorals (1.1:1) and less convenient in the shanks (0,8:1) and thighs (0,86:1) muscles.
- the chemical assessments revealed a **protein content** within muscles between the 17.94% (semimembranous females) ÷ 24.10±0.25% (superficial pectorals females) ("COBB-500" chickens), respectively within the 17.13% (semimembranous males) ÷ 23.80 (superficial pectoral females) limits ("ROSS-308" broilers);
- concerning the **protein quality** in the analysed muscles, considered by its content in **essential amino acids**, it could be stated the following:
  - in "COBB-500", broilers, lysine oscillated between 3.23 g/100g (superficial pectoral in females) – 6.75g/100 g (semimembranous males); methionine had a lower variation amplitude (3.24-3.79 g/100g), while the phenylalanine was found between the minimal value of 2.74 g/100g (semimebranous females) and the maximal one of 5.54 g/100g (superficial pectoral males);
  - for the "ROSS-308" hybrids, the lysine quantity varied between 3.31 g/100g (superficial pectoral in females) – 6.92g/100 g (semimembranous males), the methionie varied within the 3.03-3.95 g/100g limits and the phenylalanine oscillated between 2.81 g/100g (semimebranous females) and 5.78 g/100g (superficial pectoral males);
- the calculated **energetic value** revealed, once again, the dietetic features of the white meat (pectoral muscles), compared to the red meat (wings, thighs and shanks muscles). Thus, the samples in the 1st experimental series ("COBB-500" hybrids) the minimal value for the gross energy reached 138.26 Kcal/100 g product (profound pectoral from pullets) and the maximal one reached 191.73 Kcal/100 g product (semimembranous from pullets). During the 2nd experimental series, the samples caloricity varied between 138.93 Kcal/100 g product (profound pectoral in females) and 202.28 Kcal/100 g product (semimembranous from females).

Consequently to the chemical composition assessments, the pectoral muscles could be considered as qualitative superiors, mainly due to the low energetic value, to the low cholesterol content and high polyunsaturated fatty acids content;

Nutritionally speaking, although the white meat proved to be richer in proteins, its quality was lower, due to the reduced content in essential amino acids, especially in lysine. This fact could be explained by high collagen content in the structure of the pectoral muscles fibrous connective tissue.

Concerning the histological features, the best results were observed in wings muscles then in the other red muscles, indicating a thinner texture, consequently a better tenderness.

Considering the previously presented data, it is recommended to consume poultry meat, as an aliment with a high nutritional and biological and with reduced caloricity, which states as an viable gastronomic alternative to the meat issued from other species. It also could generate real benefits in the prevention of the cardio-vascular maladies or in lifestyle changes – curative diet of the consumers with cardiac/metabolic chronic diseases.

Due to their complexity and to the original characteristics of the researches within the PhD dissertation, they could be considered as unique, knowing that such studies has not been recently run within the conditions of the Romanian aviculture practice (technology, used hybrids).

The hardback version of the PhD dissertation comprises 234 pages, 73 pages (31.2%) including the study of the scientific references related to the PhD research field and 161 pages (68.8%) presenting the original research results.

January 5, 2009 **Eng. Răzvan Mihail RADU-RUSU, MSc**

##########

Please, if possible, send your review (@2 pages, Letter or A4 sized) on this abstract using the e-mail address: rprobios@gmail.com, no later than Tuesday, January 13, 2009.

Thank you indeed for your consideration!
Cordially,
Răzvan Mihail RADU-RUSU