ABSTRACT OF PhD THESIS

Aviculture, as a branch of animal husbandry, presented a great importance due to the fact that are raised many domestic birds breeds (hens, ducks, geese, turkeys, guinea-fowls, pigeons, quails) or half-domestic (pheasants, partridges, ostriches), offering to breeders the possibility to choose the right breed in connection with the local conditions.

Poultry meat is very important in human nutrition, due to its remarkable qualities. In comparison with other meat producing domestic animal breeds, birds had the advantage of providing always fresh meat. This type of meat is rapidly cooked and have numerous sensorial and nutritive qualities, from which we mention: is poorest in calories and richest in proteins (poultry "white meat" had a protein content of 21-22%, and the "red" one, 19-20%); due to its soft structure is easy to masticate and digest, being an ideal food for all ages.

At the same time, digestive features of poultry meat (low cholesterol content) quantity recommend it in children, elder and convalescent nutrition. In poultry meat are found all the essential amino acids necessary in human nutrition, and more, poultry meat and organs are a rich source in mineral salts and vitamins.

At world stage, poultry meat wins a very important place among the animal origin foods of humans especially due to its nutritive qualities and low costs in its processing, in comparison with other sources of animal origin proteins.

By poultry meat, in the broad sense of the word, we understand the skeletal musculature, together with the natural liaison tissues: lax, conjunctive, fibrous, bones, adipose, sanguine vessels, ganglions, nerves etc; sometimes, in these category are embedded the eatable organs: heart, liver, gizzard and spleen.

Unlike mammals, poultry meat had a soft texture, sanguine irrigation is reduced and conjunctive tissues are less developed. Fat is mainly deposited in subcutaneous conjunctive tissue, on gizzard, intestines, and on the internal walls of abdominal cavity. At hens and turkeys breeds could be found two types of musculature: "white", in chest region and "red" in the rest of the body. At slaughtering of different birds breeds result, on one hand, carcasses and eatable organs, and on the other hand, inedible by-products and other wastes.

From the study of literature resulted the fact that myocytes which compose the somatic

muscles at birds could be classified in two functional types, being generically named white fibres and red fibres (*Le Bihan-Duval, 2004*). Ultra-structural organization of those fibres is quite identical, but the differences between them are in dimensions and type of metabolic activity. So, the red fibres have a transversal diameter lower than white ones, are rich in myoglobin, being adapted to aerobic metabolism, fact which explain their resistance at sustained effort (slow contractions). White fibres are thicker than the red ones and poorest in myoglobin and lipids, instead are richer in glycogen, being adapted to anaerobic metabolism type and used, by organism, to effectuate an intense effort, but for a short period of time (quick contractions). In pectoral muscles, the highest share belongs to white fibres, while in members' muscles and especially in the ones of posterior members, more often are met red fibres.

Picard et al. (2003), classified myocytes in two types; first type (I) includes red fibres, with slow contraction and great resistance to effort which are very rich in lipids, myoglobin and less in glycogen. Second type (II) includes two subtypes (II A and II B). Subtype II A include also red fibres, but less resistant to a prolonged contractive action, with an increase quantity of glycogen, quite in the same proportions with lipids and myoglobin.

Subtype II B is represented by white fibres, which contain reduced rates of myoglobin and lipids and high rates of glycogen.

French researchers *Bem and Dudos, (2003),* enlightened the third category of muscular fibres (IIIa and IIIb) existed in birds' muscles, but inexistent in mammals' muscles, Third category include also fibres with low contraction, so with a mainly glycolic activity.

Regarding the structural organization of somatic muscles, it is known that striated muscular fibres are associated, having a parallel disposal and forming primary muscular fascicles (F.M.P.). These ones could contain a variable number (60-80) of muscular fibres jointed by endomysium. Primary muscular fascicles are associated in a number of 3-5-7 and form a real conjunctive "shirt", called perimysium forming secondary muscular fascicles (F.M.S.): those ones (F.M.P. and F.M.S.) are covered with a veritable conjunctive "shirt", called perimysium, which have the role to protect and to support muscular fibres.

Secondary muscular fibres are also grouped, 3-5 and form third muscular fascicles (F.M.T.), covered by epimysium, resulting the striated muscle, which have at the surface a conjunctive muscular fascia *(Nickel, 1977; Cornilă, 1995).*

All the conjunctive tissue (Toate formaţiunile lamelare de ţesut conjunctiv (endomysium, perimysium, epimysium and muscular fascia) from muscles' structure, allow them to have an independent move, forming, at the same time, special distribution routes of sanguine vessels and nerves till the level of each muscular fibre. Besides these conjunctive formations described up to

here, muscles are accompanied by other annexes, also with a conjunctive nature, like: fascias, synovial capsules and fibrous and synovial sheaths of tendons.

From literature study results the fact that, research in poultry meat production was mainly focused on quantitative aspects of production and less on qualitative aspects. Despite this must be remarked, that in the last years, in Romania, concomitantly with introduction of management systems regarding foodstuff quality in poultry meat producing companies, started to be realised some studies regarding poultry meat quality *Teuşan, (2000); Georgescu et al. (2000); Banu et al. (2002); Vacaru-Opriş et al. (2005, 2007, 2012), Radu-Rusu, (2009) etc.*

In the related context, it is necessary to be effectuated new studies regarding qualitative parameters of somatic muscles gathered form broiler chickens (histological, physical-chemical, technological and microbial characteristics), for each commercial hybrid, with is exploited and on slaughtering ages, because in the technical presentation fiches of hybrids, producing brands specify only their general growing performances, such as: dynamics of weight gain, feed conversion index, losses.

Slaughtering age of chickens is important for farmer form many angles. First of all to know at which corporal mass could obtain a maximum profit; second, he must consider the consumers demands, which at a certain moment could prefer a bigger carcass or sometimes a smaller one.

In these situations, must be proved if in poultry meat obtained at different slaughtering ages could be found superior qualitative parameters. From the above mentioned reasons in the experimental design of the current PhD thesis we had in view that quality determination of broiler poultry meat to be realised on slaughtering ages (35, 38 and 42 days).

We consider that our research aimed to a better characterization of broiler poultry meat quality, so the consumer to have the possibility to choose the meat assortment which fits best on its taste, without harming his heath state.

Research was focused on: pH value just after poultry slaughtering and after meat storage; determination of sensorial, chemical properties (by studying meat content in water, dry matter, proteins, amino acids, fats, fatty acids, caloricity, macro and micro-elements, vitamins etc.) and technological properties of analysed meat.

Up to now, the realised research in this way was rare and incomplete, so it is a necessity that studies on approached theme to be deeply.

Meat quality is influenced by numerous factors and could be appreciated through many indicators. Those indicators had a histological, sensorial, physical-chemical, technological and microbial nature. Histological indicators are very important because allow a correct appreciation

of some meat sensorial and nutritive qualities, such as, tenderness, juicy, consistency, colour, texture, fragrance (taste and smell) etc.

To obtain the desired information which have an original character, were realised a series of analysis on four somatic muscles (*deep pectoral muscle; superficial pectoral muscle; brachial biceps muscle, medial gastrocnemian muscle)*, gathered from poultry hybrid "Ross-308", slaughtered at different ages (35, 38 and 42 days); which was reared at S.C. "Avi-Top" S.A. Iaşi.

The main conclusions drawn at the end of research are the following:

At the age of 35 days, chicken mean corporal weight of both sexes was 1877.31 g, reaching to 2230.55 g at 38 days and 2569.35 g at 42 days. These results are close to the ones predicted in the technological guide for "Ross-308" hybrid and sustain the very good rearing conditions assured to broiler chickens in the working unit.

Slaughtering yield at warm increased from 79.57 % at chickens' age of 35 days, to 78.98 % at 38 days and to 79.80 % at 42 days. Decreasing of slaughtering yield values after carcasses' refrigeration wasn't significant, being in the normal limits.

Rate of the cut portions in carcass enlightened a very good rate for breast and leg foot. So, the rate of breast with bone and skin varied between 29.43 % at chickens' age of 35 days and 29.46 % at the age of 42 days.

Simultaneous, leg foot rate, in the same period of time, oscillated between 13.67 % and 13.69 %, while participation of thighs was 15.44-15.47 %.

Weight of analysed muscles (superficial pectoral, deep pectoral, brachial biceps and medial gastrocnemian) was appreciated as being higher; so for example, the weight of superficial pectoral muscle was 264.66 g at chickens' age of 35 days, 313.69 g at 38 days and 360.99 g at 42 days. Between sexes were enlightened significant statistical differences and even very significant ones.

Regarding weight of brachial biceps muscle, these one varied between 8.35 g at the chickens' age of 35 days and 12.19 g at the age of 42 days, and the weight of medial gastrocnemian muscle, between 19.15 g ay 35 days and 27.84 g at 42 days. Also in this case were founded significant statistical differences and very significant between sexes.

Highlighted are worth to be mentioned the dimensional and morphological aspects of those four studied muscles and observed by us. So, superficial pectoral muscle had a triangular prism shape, thickness varying between 2.4-2.5 cm at chickens' age of 35 days and 2.4-2.9 cm at the age of 42 days. As regarding the length of the muscle, in the same period of time, oscillated between 17.1 and 19.0 cm.

By cytometric measures (on muscular fibres) and histometric (on first order muscular fascicules) were obtained the necessary elements for calculus of muscular fibres density per

square unit and participation rate of main tissue in analysed muscles. In paper are also presented a series of images micro-photographed at microscope.

Mean diameter of myocytes was:

- in superficial pectoral muscle:
  - at chickens' age of 35 days, 51,02 µ at males and 51,95 µ at females;
  - at chickens' age of 38 days, 51,19 µ at males and 52,20 µ at females;
  - at chickens' age of 42 days, 52,64 µ at males and 53,03 µ at females.
- in deep pectoral muscle:
  - at chickens' age of 35 days, 36,20 µ at males and 37,12 µ at females;
  - at chickens' age of 38 days, 36,38 µ at males and 37,46 µ at females;
  - at chickens' age of 42 days, 39,59 µ at males and 39,95 µ at females.
- in brachial biceps muscle:
  - at chickens' age of 35 days, 29,22 µ at males and 28,03 µ at females;
  - at chickens' age of 38 days, 29,42 µ at males and 27,13 µ at females;
  - at chickens' age of 42 days, 31,29 µ at males and 30,86 µ at females.
- in medial gastrocnemian muscle:
  - at chickens' age of 35 days, 36,77 µ at males and 42,46 µ at females;
  - at chickens' age of 38 days, 38,77 µ at males and 42,56 µ at females;
  - at chickens' age of 42 days, 40,77 µ at males and 44,03 µ at females.

Density of myocytes from superficial pectoral muscle (number of muscular fibres/mm^2) varied between 268.59 for males and 272.14 for females, at chickens' age of 35 days and 255.02 for males and 264.93 for females, at 42 days. From the above presented aspects results that, myocytes were thicker at females than at males, situation correlated with the obtained values for density. In the same time, could be observed that myocytes density decreased with birds' age. Similar situations were observed also for the rest of studied muscles, deep pectoral muscle, brachial biceps muscle and medial gastrocnemian muscle (with some small exceptions).

Rate of the main tissue categories from superficial pectoral muscle and deep pectoral muscle show us a decreasing of striated muscular tissues with birds' aging. So for example, the striated muscular tissue from superficial pectoral muscle represented 58.25-65.52 %, at chickens' age of 35 days and 54.11-65.18 %, at the age of 42 days.

Rate MT/CT (striated muscular tissue/conjunctive tissue) was correlated with the above presented data. For example, in superficial pectoral muscle, rate MT/CT, at chickens' age of 35 days was 1.39/1 for females and 1.90/1 for males, and at the age of 42 days, 1.18/1 for females and 1.87/1 for males, while for medial gastrocnemian muscle, values varied between 1.45/1 (males) – 1.46/1

(females), at chickens' age of 35 days and 1.51/1 (males) – 1.55/1 (females), at 42 days.

Chemical composition of analysed muscles and their energetic value didn't reveal significant differences face to the ones cited in literature for the presented situation.

Protein content in superficial pectoral muscle was between limits of 22.16-22.21 %, at chickens' age of 35 days and 22.02-22.07 % at 42 days, in deep pectoral muscle, these one oscillated between 22.16-22.55 %, at chickens' age of 35 days and between 22.54-22.36 %, at 42 days.

Other values were obtained for brachial biceps muscle and medial gastrocnemian muscle; so, in brachial biceps muscle, protein content varied between 19.58-19.71 %, at 35 days and 20.00-20.12 %, at 42 days. For medial gastrocnemian muscle, obtained protein content was even lower 17.20-17.15 %, at chickens' age of 35 days and 18.65-18.94%, at 42 days.

Regarding lipids content, this one was at higher level in brachial biceps muscle and medial gastrocnemian muscle face to superficial pectoral muscle and deep pectoral muscle. For example, in pectoral muscles (superficial and deep), lipids content was around 1 %, while at member muscles (brachial biceps and medial gastrocnemian) determined values varied between 3.82-4.81 %, in brachial biceps muscle and between 6.33-7.78 %, in medial gastrocnemian muscle, inversely proportional in comparison with the established values for proteins.

Content in amino acids and fatty acids (mono-saturated, polyunsaturated and saturated) from the studied muscles didn't had a significant variation between all four muscle, obtained values shown a very good quality of the studied meat from those angles.

It could be remarked the low cholesterol content of all four muscles, varying between 56-59 mg/100g, in superficial pectoral and deep pectoral muscles which provide "white meat" and between 60-75 mg/100g in brachial biceps and medial gastrocnemian muscles which assure "read meat". Naturally, cholesterol content was higher in medial gastrocnemian muscle in comparison with brachial biceps muscle, correlated with lipids level.

Face to the above presented, we can conclude that nutritive value of the analysed poultry meat was higher, fact proven in scientific way, with a lot of arguments.

Between meat of the chickens slaughtered at age of 35 days and the ones gathered at older ages (38 and 42 days) weren't founded significant qualitative differences, so the breeders of "Ross-308" broiler hybrid 35-42 days, which is variable function of mean corporal weight, production costs and the request of consumers for a big or small carcass.