

## ABSTRACT

PhD thesis entitled *“Research concerning the qualitative characterization of turkey meat by traceability analysis”* is structured in two distinct parts: data from literature and the one represented by own research.

First part present in 3 chapters a synthesis of the literature regarding traceability elements of poultry meat from farm to sale for assuring the guarantee of consumers' food security through quality products, as a result of compliance of rearing technologies, pre-sacrificing stages and slaughtering technologies utilised on national and international level.

Second part deals with own research and have 9 chapters in which the general aims were consolidated based on evaluation of the effects induced by age influence, application of rearing technologies in accordance with Big BUT 6 turkey hen broiler guide, pre-sacrificing procedures, technological flow stages with influence on technologic, physical-chemical, microbiological and sensorial indicators.

Scientific research realised on national and international level highlighted the importance of traceability application on food chain to identify the conformity of obtained products, correlation between technological parameters which deals with growing and dynamics of corporal weight. Fodder and water consumption, fodders' quality, age, environmental factors, bio-security, rearing density are in a close connection with the mortality recorded in rearing shelters, health state, slaughtering efficiency, chemical, physical, microbiological and sensorial indicators evaluated for turkey hen meat. Factors such as: diet, manipulation, and density in conveyance means and also the time for birds' rest before slaughtering have a major influence on recorded mortality at slaughterhouse, on physical, microbiological and sensorial indicators of turkey hen meat.

To achieve the proposed aims, research were carried out on a number of 5050 turkey hens and turkeys belonging to Big BUT 6 broiler divided in two experimental batches ( $L_1$  and  $L_2$ ) at a farm owned by S.C. Galli-Gallo S.R.L., Codlea. The batches ( $L_1$  and  $L_2$ ) were differentiated by slaughtering age, 16 weeks respectively 18 weeks. Because some indicators weren't able to be determinate for the whole bird flock, we formed some randomized control groups, one for each

experimental batch, summing 15 heads per batch.

Having in view that experimental protocol of current research aims with meat qualitative characteristics from physical-chemical, sensorial, microbiological point of view, samples were gathered from four types of muscles (breast, upper thigh, lower thigh and wings).

The first mandatory stage from rearing technological management is represented by pre-heating of rearing shelters. This operation was effectuated with 48 hours before populating and had the role to assure a friendly microclimate for birds and which do not lead to apparition of thermal stress or of some diseases provoked by sudden variations of temperature. For heating the shelters were utilised gas heaters systems, at rearing farms I, or blowers which utilised the same fuel type and were placed in rearing halls II. Gas heaters were mounted in a way to serve a surface of 14 m<sup>2</sup>.

In the first three days of birds life, temperature determined under brooder recorded values of 38.9-40°C in hall destined for batch L<sub>1</sub> and 39.1-39.7°C in hall L<sub>2</sub>. Till the end of growing period I temperatures decreased so the recorded values were 30.5-31.7°C for L<sub>1</sub> and 30.4-31.9°C for L<sub>2</sub>. Afferent interval for starting of growing period II implied elimination of brooders and utilisation of blowers, temperature in L<sub>1</sub> hall presented oscillation limits of 27.1-26.2°C, for hall L<sub>2</sub> temperatures were 26.8-28.1°C.

As regarding the air moisture content and ventilation could be appreciated the fact that at all experimental batches were assured values in according with the normal limits imposed by rearing guide. Were respected the demands from rearing technological guide regarding microclimate parameters and were established lighting schedules in according with age and destination, for increasing quality and quantity of meat production. Studied microclimate factors didn't record very significant variations from a hall to another.

Analysing the chemical composition of fodders was observed the fact that in the first 6 weeks of birds' life, percent of gross protein was superior to the one administrated in the further stages, being 28.12% in interval 0-3 weeks and 25.98% in period 4-6 weeks. Interval 7-10 weeks was characterized by assuring of a percent of 24.20% protein, value for this parameter decreasing up to 17.40% as it was recorded in period 16-18 weeks. Energetic level necessary for development of musculature and activity of turkeys was assured into an interval with a lower value of 2933 kcal/kg (0-3 weeks) and an upper value of 3363 kcal/kg (16-18 weeks). By balancing the amino acids in nutrition of turkey hens and turkeys destined for slaughtering was assured the obtain of meat with a high protein rate, and by decreasing of energy consumption in organism, in comparison with the utilised fodders in growing stage I when raw materials were rich in protein and needed high energy quantities for splitting.

Conditions imposed for water utilised for turkey hen chickens were related with physical-

chemical and microbiological quality. Water utilised for birds' consumption didn't have excessive quantities of minerals, wasn't contaminated with micro-organisms, being in the admissible limits regarding hardness and nitrites and nitrates level.

Study of three most important parameters, represented by daily mean gain, cumulated fodder consumption and feed conversion index, was realised in each life week of birds. A comparison between those two batches at slaughtering age, was observed a good uniformity between them regarding mean corporal weight of 12.97 kg for L<sub>1</sub> and 12.86 kg for L<sub>2</sub>, specific consumption being 29.48 kg/head for L<sub>1</sub> and 29.35 kg/head for L<sub>2</sub>. Consumption index was at a level of 2.27 for batch L<sub>1</sub> and 2.28 for batch L<sub>2</sub>, differences being insignificant. Situation of exits from flock was attentively monitoring on the whole growing period, results being weekly noted. The balance realized in week 16, moment which coincides with finalization of growing for individuals from batch L<sub>1</sub>, enlightened a lose per total period in percentage of 3.21%, and for experimental batch L<sub>2</sub> at the slaughtering age of 18 weeks was recorded a percentage of 3.48%, calculated for the whole life cycle.

Due to the fact that farm in which rearing of experimental batches took place was in the proximity of slaughterhouse, the distance between them being of 500 m, birds' transport had a short duration (around 5 minutes), fact which create a series of advantages such as: speed, short transportation period, decreased thermal stress, low mortality, minimal loses in weight.

Tracking the slaughtering technological flow from S.C. Galli-Gallo S.R.L. aimed to identify the suitable technological parameters for each stage, and also hygiene in unit which could present microbiological risks. Technological stages applied during slaughtering had an influence on technological indicators, physical, microbiological and sensorial parameters of turkey hen meat as final product. Application of gradual stunning with CO<sub>2</sub> with concentration between 5 and 70% represented an advantage regarding elimination of stress caused by hanging of birds on conveyer, a very good bleeding, and reduction of haemorrhages at musculature level, reduction of dust emission. Good results for qualitative level of carcasses is represented by tendons tearing from lower thigh using a fully automatic equipment which at the same time made an automatic transfer of non-eviscerated turkey carcasses from slaughtering line of conveyer to the evisceration line. Trimming of carcasses is realised with ozone water, to decrease the microbial contamination of carcasses.

By implementation of HACCP system in firm were periodically gathered sanitation tests for control of hygiene state, and also samples from ozone water utilised at carcasses and organs trimming. Results of laboratory analysis were shown into an analysis bulletin. Incidence of coliforms bacteria and staphylococcus was under the admissible limits in samples gathered from conveyer belts for carcasses and organs, from conveyer hooks, from gloves utilised by operators

at evisceration and trimming, from walls and floors, from knives, and also from water samples.

On the base of gravimetric determinations of carcasses obtained at slaughtering and after 24 hours of refrigeration allow us, to calculate the slaughtering efficiency. By reporting the weight of cut parts to carcasses' weigh, was calculated the rate of those commercial meat assortments in carcass composition. Efficiency obtained at slaughtering,  $74.99 \pm 0.15\%$   $L_1$  and  $75.75 \pm 0.15\%$   $L_2$ , was in the limits specified by the producers of Big BUT 6 broiler, data being statistically processed. As regarding the participation of pectoral muscles were recorded significant differences between the representative carcasses of batches  $L_1$  and  $L_2$ , the obtained average being  $39.1 \pm 0.31\%$  and respectively  $40.19 \pm 0.24\%$ . Differences between the others anatomical portions, upper thigh, lower thigh, wings were insignificant between the two batches.

In birds' post-slaughtering period associated with *prerigor mortis* phase, at 20 minutes after slaughtering the gathered meat from turkey hens broilers belonging to experimental batch  $L_1$  recorded mean values placed in interval  $6.23 \pm 0.02$  (breast) and  $6.38 \pm 0.02$  (lower thigh), and for muscular tissue gathered from turkey hens in batch  $L_2$  representative mean value were  $6.24 \pm 0.01$  (breast) and  $6.39 \pm 0.02$  (lower thigh). Starting with maturation phase, samples gathered from representative muscular tissues of turkey hens and turkey carcasses presented a pH mean value between  $5.87 \pm 0.01$  (breast), recorded at carcasses from  $L_1$  and  $6.09 \pm 0.01$  (lower thigh) for batch  $L_2$ . The pH values had an ascendant way after 72 hours, recorded limits being  $5.99$  (breast) ÷  $6.24$  (lower thigh). Values of pH for all the studied muscles were in according with meat qualitative conditions.

Characterization of turkey hen meat colour function of age for the studied muscular samples shown a suitable mean values for luminosity ( $L^*$ ) at batch  $L_1$ , between  $44.74 \pm 0.72$  (upper thigh) and  $48.44 \pm 0.36$  (wings) and  $44.04 \pm 0.3$  (lower thigh) ÷  $48.35 \pm 0.33$  (wings) representative for batch  $L_2$ . Regarding the coordinate of complementary colours red-green ( $a^*$ ) the recorded minimums were specific to pectoral musculature for  $L_1$  ( $-0.38 \pm 0.09$ ), calculated maximums being responsible with musculature of upper thigh from experimental batch  $L_2$  ( $5.52 \pm 0.12$ ).

The values of shear forces were in a direct relation with aging, so in the case of birds slaughtered at the age of 16 weeks ( $L_1$ ) were recorded values of  $10.48 \pm 0.41$  N/cm<sup>2</sup> (breast), while at turkey hens and turkeys slaughtered at age of 18 weeks ( $L_2$ ) the obtained were higher,  $14.45 \pm 0.5$  N/cm<sup>2</sup>.

At the level of all analysed muscular groups, recorded valued for dry matter in the analysed muscular samples from  $L_2$  is superior to the one determined at the samples gathered from  $L_1$ , average content being between  $25.45 \pm 0.21$  (lower thigh) ÷  $27.32 \pm 0.23\%$  (wings).

Based on determination of constituents from pectoral musculature is considered to be

superior from qualitative point of view under the aspect of high content in proteins ( $24.80 \pm 0.20\%$ ,  $L_2$ ), inferior mean values ( $18.43 \pm 0.26\%$ ,  $L_1$ ) being characteristic to upper thigh. Values obtained for total lipids in turkey hens meat had a great variation amplitude between the studied muscles, obtained means being  $1.06 \pm 0.05\%$  (breast) and  $4.73 \pm 0.18\%$  (upper thigh), content in total lipids of  $L_2$  batch musculature being superior to the one from musculature of batch  $L_1$ . At the same time with aging water percent decrease and increase the content in proteins and dry matter.

Incidence observed for *Salmonella spp.* isolated from cecum and neck skin was in the normal limits, being not detected colonies at the end of microbiological examination.

Regarding the number of *Campylobacter spp.* colonies as an indicator of their presence in cecum samples at turkeys from batches  $L_1$  and  $L_2$ , the results show a lack of development on culture environments.

At the end of bacteria examinations for *E. coli*, the obtained results shown that for the samples gathered from batches  $L_1$  and  $L_2$  didn't exist a contamination degree, fact which place them into the admissible limits, offering a positive answer regarding the applied hygienic conditions before slaughtering and during slaughtering process, as well as a positive influence of utilization of ozone water in specific stages of slaughtering.

By sensorial analysis of turkey hen meat realised on the basis of appreciation of colour, flavour, aspect, taste and texture, pectoral musculature samples gathered from birds slaughtered at age of 16 weeks were appreciated through a favourable ranking, being a superior product from juicy and texture point of view. Meat gathered from birds slaughtered at age of 16 weeks is characterized by a more pronounce colour uniformity and meat gathered from birds slaughtered at age of 18 weeks is characterized by a superior intensity of flavour, influence factors being age and fattening state.

At the end of effectuated research regarding obtaining of turkey hen meat by a correct application of rearing and slaughtering technologies could be noticed a superior quality of meat from nutritional and sensorial point of view which make it an almost ideal product for human consumption.