SUMMARY

Keywords: hen broiler, hygiene, decontamination, quality, meat

The sanitation of food products can greatly influence human health, thus they need to fulfill the triad: to give pleasure, to nourish and not to harm the consumer, that is, to meet all the psycho-sensory and hygienic-sanitary criteria.

Poultry meat production has been continuously increasing in the past decades, both nationally and internationally, due to its nutritional qualities and low production costs in comparison to other sources of animal proteins.

The hygienic-sanitary control at various technological stages during the production process, the processing and the storage of poultry meat can prevent its contamination when the biosecurity, vaccination and hygiene standards are taken into consideration.

The modern technology applied in slaughterhouses has created superior hygiene conditions as well as qualified supervision and control, which has led to the provision and guarantee of microbiologically safe products.

However, the incidence of food-borne infections of the *Salmonella* and *Campylobacter* genus is still quite common and still largely extended, with important economic and social effects.

For these reasons, within the doctoral thesis entitled "***Contributions to the knowledge of the sources of microbiological contamination of poultry meat in some specialized units in Iaşi County"*** we intend to study the possible sources of microbial contamination, starting with the breeding halls of broiler chickens and their slaughtering.

Several objectives were considered in the research.

The first purpose of the research was to identify the sources of microbial contamination in the poultry complexes of our study, the main objectives being the hatching eggs, the one day-old chickens, the breeding places of the hen broiler and the mixed fodder which has been administered to them.

In order to achieve this objective, sanitation samples were taken from the two units under study in two different seasons (summer-winter) to be tested bacteriologically for *Salmonella spp., Escherichia coli, Staphylococcus spp*. and *Streptococcus spp* .

As far as the contamination of hatching eggs was concerned, we need mentioning that in both harvest seasons the same types of bacteria (*Escherichia coli and Staphylococcus spp*.) have been identified.

In the summer season, 15% of all samples taken from unit A were positive (12.5% for *Escherichia coli* and 2.5% for *Staphylococcus spp*.) and for unit B from the total of the analyzed samples, 47.5% samples were positive, of which 30% were for *Escherichia coli* and 17.5% for *Staphylococcus spp*. In the winter season, all analyzed samples were negative.

The analysis concerning the one day-old chickens in unit A indicated that during the summer season, 65% of the samples under scrutiny were negative and the difference was made of positive samples (25% for the *Escherichia coli* parameter and 10% for *Staphylococcus spp.*) in the winter season all the samples were positive.

For unit B, the tests performed during the summer season revealed that 50% of the samples were positive, of which 35% for *Escherichia coli* and 15% for *Staphylococcus spp.*; in the winter season, 10% of the analyzed samples were positive for *Escherichia coli*.

In order to assess the degree of contamination of the breeding areas, several microbiological parameters (*NTG, yeasts + molds, coliform bacteria, Enterobacteriaceae, Staphylococcus spp*.) were analyzed over three different periods (immediately after the sanitary vacuum and then at the age of 16

and respectively 21 day-old of the chickens), from the watering lines, the forage ones, the hall walls and the forage bunkers.

The results obtained in unit A were totally negative for *yeasts + molds, coliform bacteria, Enterobacteriaceae* and *Staphylococcus spp.*,while for the total number of germs there were 5% positive samples found (0.71% -1.42 % of all verified items). And in unit B, the results of *yeast + mold tests, coliform bacteria, Enterobacteriaceae* and *Staphylococcus spp*.were 100% negative, but for the total germ counts, 4.28% positive samples were found (for all tested items).

The bacteriological examination of the breeding hall in 16-day-old chickens showed that in unit A, bacteria of the genus *Staphylococcus spp*.were present at a rate of 2.14% (hall walls), those in the *Enterobacteriaceae* genus at a rate of 10.71% (3.6% in watering lines, 2.80% in feed lines, 1.40% in fodder bunkers, 2.8% in the hall walls), *coliform bacteria* were present 12.85% (5.7% in the watering lines, 3.57% in fodder lines, 1.42% in the fodder bunk, 2.14% in the hall walls) and the presence of *yeasts + molds* was 3.57% (1.42% in fodder lines, 2 , 14% in the hall walls); the values obtained for NTG were the highest, with a 25% positive sample (6.42% in watering lines, 7.14% in forage lines, 7.85% in the feed hopper, 3.57% in the hall walls).

In unit B, the results obtained at the same age of the chickens (16 days) were 1.42% positive for *Staphylococcus spp*. (0.71% in watering lines, 0.71% in feed lines), 14.55% samples were positive for the *Enterobacteriaceae* bacteria (8.85% in water lines, 2.14% in feed lines, 2.14% in the forage bunker, 1.42% in the hall walls) and 12.14% were positive samples for coliform bacteria (5% 28% in fodder lines, 1.42% in the fodder hopper, 1.42% in the hall walls); for the total number of germs, the percentage of positive samples was 22.85% and the yeast and molds ratio was of 2.85%, with microbial growth on all checked items.

Checks performed in 21 day-old chickens showed that the degree of contamination was higher than the previous one.

Thus, in unit A, out of the total samples analyzed, 8.57% were positive for *Staphylococcus spp*. (2.85% in watering lines, 2.14% in fodder lines, 2.14% in hall walls, 1.42% in the fodder bunker), in the feed hopper, 3.57% in the hall walls), 27.14% *coliform bacteria* (8.57% 7,85% in the fodder lines, 5% in the feed hopper, 5,71%in the hall walls), 29,28% NTG and 8,57% *yeast + mildew*.

The degree of contamination of unit B (in 21 day-old chickens) was as follows: 7.85% positive samples for *Staphylococcus spp*. (2.85% in watering lines, 1.42% 42.5% in the hall walls, 2.14% in the feed hopper), 18.57% positive samples of *Enterobacteriaceae* (5.71% in the watering lines, 6.42% in the feed lines, 3.57% in the feed hopper, 8.85% , 28.57% positive samples from *coliform bacteria* (8.57% in the watering lines, 8.57% in feed lines, 6.42% in feed hopper, 5% hall walls); the percentage of positive samples (for all tested items) was 28.57% for NTG and 6.42% for *yeast + molds*.

Combined feeds (start, growth and finishing) administered in the two growth units in the two seasons were analyzed for the following contaminants: *Salmonella spp., Escherichia coli* and *yeast + molds*.

As far as *Salmonella spp.* is regarded, its presence was not detected in none of the feeds used in the two units in both seasons (summer - winter).

For the forage used in unit A during summer, *Escherichia coli* was detected at levels ranging from 0.36 ufc/g (start) and 15 ufc/g (finishing), as well as yeasts + molds with levels ranging from 454 ufc/g (start) and 4909 ufc/g (increase). In the winter season, for the *Escherichia coli* parameter, values ranging from 0.82 ufc/g (start) and 4.3 ufc/g (increase) were found, and for yeasts + molds between 303 ufc/g (start) and 2967 ufc/g (increase). We mention that these values fall within the limits imposed by current regulations.

In unit B, the results of the microbiological analyzes performed in the summer season indicated levels ranging from 0.16 ufc/g (start) and 3.5 ufc/g (finishing) to the *Escherichia coli* test

and between 453 ufc/g (finishing) and 5909 ufc/g (increase) for *yeast + molds*; the results obtained for fodders administered in the winter season indicated the presence of *Escherichia coli* bacteria (0.92-2.3 ufc/g), but also *yeasts + molds* (329-3679 ufc/g).

The check of contamination from other sources concerned equipment used in incubation stations (egg transportation machines and egg formworks) and one day-old chickens transportation (transport vehicles and chicken shuttles), and sanitary samples were collected for the following parameters: *Staphylococcus spp*., *Salmonella spp*. and *Escherichia coli*.

These microbiological assessments revealed that the hygiene and decontamination standards of the equipments that come into direct contact with the hatching eggs and the one day-old chickens were observed in both establishments, as evidenced by the negative results for the presence of the tested bacteria species.

To assess the hygiene of personnel handling chickens in breeding farms, bacteriological examinations were performed by sampling (gowns, gloves and hands), following the presence / absence of the following pathogenic bacterial species: *Staphylococcus spp., Salmonella spp. Enterobacteriaceae.*

According to the results obtained (100% negative samples), it can be stated that all hygiene and biosecurity conditions specific to the poultry sector have been respected at all levels in the objectives that were assessed.

The second objective of the research focused on assessing the productive performance of the chickens raised under the conditions provided by the two poultry complexes.

According to the data obtained for unit A, the body weight of the chickens at the end of the growing period (40 days) was 2556.80 ± 13.24 g in the warm season (total growth increase = 2439.28 g/period) and of 2534.92 ± 8.89 g in the cold season (total growth increase = 2493.12 g/period). The feed conversion index for the studied period (1-40 days) was at the level of 1,667 kg n.c/ kg growth rate in the warm season and 1,669 kg n.c/ kg growth rate in the cold season.

For chickens in unit B, body weight at slaughter (age 40 days) was 2445.86 ± 23.27 g in the warm season (total span of 2405.67 g/period) and 2528.86 ± 4,26 g in the cold (total increase of 2487.71 g/period); the conversion index calculated over the total period (1-40 days) was 1,665 kg n.c./kg groth rate in the warm season and 1,667 kg n.c./kg growth rate increase in the cold season.

The outflows in chickens reared in unit A were 2.38% in the warm season and 2.14% in the cold season, and for the chickens in unit B, 2.4% in the warm season and 2% in the cold season. The mortality rate of the two units studied was below 5% as indicated in the Ross-308 Hybrid Growth Guide.

The 3rd objective aimed at the identification of the microbial contamination in the two slaughter units (abattoirs) which were examined, both biological material (live birds, carcasses, either eviscerated or not, as well as chilled carcasses), along with other sources of contamination (workspaces, machinery, staff members and finite product packaging); for this purpose, samples were taken for the following indicators: *NTG, Escherichia coli, Salmonella spp*. and *Campylobacter spp.*

The results pertaining to the degree of contamination of live poultry from unit A indicate a level of 1.7×10^3 ±19.19 cfu/ml for the total number of germs and 1.3×10^3 ± 23.25 cfu/ml *Escherichia coli* while for the live birds in unit B the values detected for the two microbiological parameters mentioned above were 1.6×10^3 ± 35.89 cfu/ml and 1.3×10^3 ± 26.63 cfu/ml, respectively.

In both units, all samples analyzed for *Salmonella spp*. and *Campylobacter spp*. were negative, indicating that the hygienic and biosecurity programs were strictly monitored in breeding farms.

The following sanitation sampling was carried out prior to the evisceration of the carcasses, during which such results were obtained: the average value of the total germs number was 8.7×10^2± 14.66 cfu/ml in unit A and of 8.5×10^2 ± 12.53 ufc/ml in unit B, and for *Escherichia coli* of 4.8 x 101

± 1.37 cfu/ml (unit A) and 4.6 x 10^1 ± 1.10 cfu/ml (unit B); in both units, the samples examined for the identification of *Salmonella spp*. and *Campylobacter spp*. were negative.

The third sampling was performed after the evisceration stage, when the total number of germs recorded an average of 7.9 x10^2 ± 13.10 ufc / ml in the carcasses in unit A and 7.9 x10^2 ± 12,22 ufc/ml in unit B, and the *Escherichia coli* parameter of 4.2 x10^1 ± 1.09 ufc / ml and 3.9 x 10^1 ± 1.13 ufc/ml, respectively. All the samples analyzed for *Salmonella spp*. and *Campylobacter spp*. were negative, indicating that in both units the biosecurity and the hygiene programs were carefully fulfilled during the technological slaughtering flow.

The final step of collecting the sanitation samples from the biological material was done at the end of the carcasses refrigeration process, averaging 3.9 x 10^2 ± 8.47 cfu/ml (unit A) and 3.8 x10^2 ± 7,35 cfu/ ml (unit B) for the total germs number and 2.9 x 10^1 ± 1.25 cfu/ml (unit A) and 2.9 x 10^1 ± 1.00 cfu/ml (unit B) for bacteria of the genus *Escherichia coli*. The results obtained for *Salmonella spp*. and *Campylobacter spp*. parameters were negative in both examined units.

In order to check the effectiveness of the decontamination applied to the equipment, surfaces and machinery of the slaughterhouses in the two units under study, sanitation tests were collected for the following parameters: *NTG, coliform bacteria* and *Enterobacteriaceae.* The analysis showed that in both cases all samples (100%) were negative, so the hygiene standards regarding the equipment used in the slaughtering process were strictly followed.

As far as the degree of contamination of the service staff is regarded, as well as the packaging used in the two slaughterhouses, the microbiological analyses for the identification of Staphylococcus *spp., Salmonella spp., Enterobacteriaceae, coliform bacteria, NTG* and *yeast + mold* were totally negative, which leads to the conclusion that the specific hygienic conditions were also followed.

The last objective of the research was the quantitative production of meat obtained from broiler chickens reared and slaughtered under the conditions provided by the two units under study. From this point of view, it was found that the slaughter yield was 76.12 ± 0.16% in chickens from unit A and 75.86 ± 0.94% in those from unit B.

Chest weight averaged 654.10 ± 4.39 g (37.94% of the case) in chickens from unit A and 656.65 ± 4.54 g (38.32%) in those of unit B, legs weight of 455.55 ± 7.31 g (26.17%) for unit A and 449.25 ± 7.58 g (26.17%) for unit B, and the wings weight of 187.15 ± 3.29 g (10.85%) and 190.65 ± 3.28 g (11.10%) respectively; for the cutlets, weights of about 429.85 ± 14.39 g (24.80%) were found in chickens in unit A and 420.05 ± 13.88 g (24.41%) in those from unit B.

Taking into consideration the research and the results obtained, several recommendations have been formulated for the poultry meat production practice:

• the use of specific decontamination measures at all poultry production levels, from hatchery to poultry slaughterhouses;

• following hygiene rules throughout the poultry meat production range and in particular at the slaughtering level;

• obeying the "all-naked, full-fledged" principle in chicken broiler farms, immunoprophylaxis programs appropriate to this category of birds and the minimum 10-day lapses between two growing series;

• increasing the number of controls focusing on the level of contamination in the production units in order to take corrective measures in due time whenever it is necessary to do so.