# ABSTRACT

Poultry husbandry was and will be a significant source of animal proteins with high biological value, achieved under acceptable costs. Therefore, the knowledge and the management of those facts influencing fowl productions are key elements that could be used to increase them, both quantitative and qualitative.

An essential role in the appliance of poultry rearing, selection and breeding programs is played by the optimisation of reproduction biological processes. These could be used to manage the activity from a poultry production fowl, finalised by the achievement of good incubation eggs and day old chickens, influencing thus both production and economic performances. Consequently, the incubation sector plays a fundamental role, knowing that different influential factors act within. Among these, **eggs sanitisation** could be the key factor in providing high hatching levels and best day old chickens quality.

Several eggs sanitisation techniques are indicated by the scientific literature but most of the results issued from their usage are not conclusive enough or even controversial. The introduction of certain optimized sanitisation technologies is a main target to reach in order to significantly improve the eggs incubation performances.

The researches included in this PhD dissertation focus on the same topic, trying thus to assess the technical and economical efficiency of eggs decontamination, through the usage of an original mixture of decontaminant solutions, designed to significantly decrease the microbial payload of the eggshell.

**Experimental series I** comprised 3 experimental groups of eggs: a control group (Lc1) and 2 experimental treatments (L1exp. and L2exp.). Therefore, 3 decontaminant substances have been used as experimental factors, under different concentrations: *chloramine 4‰ + sanajod 0.06%*, in L1exp. group and *virocide 0,2% + sanajod 0,06%* in L2exp. group. The incubation period varied between groups, as specified in the experimental design.

Classical decontamination of the eggs has been done in control group – Lc1, using, *formalin* vapours*, 30% solution. The eggs issued from* „Ross-308" broiler breeders, aged 35 weeks. The newly hatched chickens have been reared in climate controlled halls, on permanent litter, maintaining the same grouping, as in incubation (Lc; L1exp. and L2exp.).

Studied indices:

- **during eggs incubation**
  - dynamics of the physical incubation parameters into the devices hosting the eggs;
  - dynamics of eggs weight looses during incubation;
  - microbial payload on the eggshell;
  - % eggs fertility;
  - % eggs hatchability;
  - % eggs hatching;
  - day old chickens weight;
- **during the rearing of the chickens hatched from treated eggs**
  - live weight dynamics;
  - feed intake;
  - flock casualties;
  - quantitative and qualitative meat production, after chickens slaughtering.

During the **II$^{nd}$ experimental series**, a new decontaminant has been studied for the very first time. This is named *natrium dichlorideisocyanurate* and is produced by the Zoohygiene department of the Veterinary Medicine Faculty in Iaşi, led by Prof. Ioan Coman, PhD.

The researches have been run on 4 groups of eggs, meaning a control group (Lc2) and 3 experimental ones (L3exp., L4exp. and L5exp.).

In control group (Lc2), the eggshell has been decontaminated as in Lc1 group (from the 1$^{st}$ experimental series), according with the classic technology, with formalin vapours, 30% solutions, while in the experimental groups, the decontaminant was represented by *natrium dichlorideisocyanurate*, in different concentrations, meaning: 0.2 g ‰ a.s. in L3exp.; 0.4 g ‰ a.s, in L4exp. and 0.6 g ‰ a.s. in L5exp. group. The decontamination technique presented an original contribution, as viewed in the experimental design. The eggs issued from „COBB-500" broiler breeders, aged 31 weeks.

The newly hatched chickens have been studied across their development in climatized halls, on permanent litter, using the same experimental groups from hatching (Lc2.; L3exp.; L4exp. and L5exp.), and their production performances was assessed.

The indices studied during the *I$^{st}$ experimental* series have been used in the *II$^{nd}$ one*.

Moreover, the microbial payload in the chickens halls has been measured.

The main conclusions issued from the 1$^{st}$ experimental series are listed below:

**a) On the incubation process**

1. After decontamination efficiency testing, a significant decrease of the microbial payload on the shell was observed in experimental groups, compared to the control one; thus, this decrease reached 50% in Lc1 group; 80% in L1exp. group and 90% in L2exp. group.

2. Eggs hatching proportion reached 87.32% in control group (Lc1), being higher in the experimental groups, meaning 88.32% in L1exp. and 87.55% in L2exp.
3. Concerning the hatched chicks weight and compared to the control group (= 100%), the differences were + 0.28% in exp. group 1, respectively -2.35% in experimental group 2.

**b) On the growing performances of the studied chickens**

1. The superiority of the experimental groups was observed against the control group, concerning the weight gain dynamics, meaning +3.7% in L1exp. and +7.2% in L2exp., at the end of the trial. Distinguished significant differences also occurred ($p < 0.01$) for the comparisons we run.
2. The average daily gain differences (+1.56 g/day in L1exp. and +2.94 g/day in L2exp., compared to the control), were correlated with the feed conversion ratio values, which were lower in the experimental groups: - 0.100 kg feed/kg gain in L1exp. and 0.200 kg fees/kg gain, in L2exp.

**c) On the quantitative and qualitative meat production**

1. At the end of the growing period, 50 chickens have been randomly selected from each group (25 females and 25 males), in order to assess the quantitative and qualitative features of meat production.
2. The achieved results indicated better values in experimental groups, compared to the control group. Relevant differences occurred for the carcass trenched parts. Thus, expressed for both genders, carcass weight was 8.9% higher in L1exp. group and 2.6% higher in L2exp. group. Relatively to the trenched parts (breast fillet, thighs and shanks, wings, remnants), the experimental groups proved to have 1.0-9.5% better values than the control one.
3. Meat weight in carcass was 10.9% higher in L1exp., compared to the control – Lc1, while bones weight was 7.1% lower. L2exp. group presented slightly lower values than the control.

*It resulted the superiority of the studied indices at the experimental groups L1exp. and L2exp., compared to the control group – Lc1. Therefore, we recommend the usage of sanitisation programs applied in the experimental groups (chloramine 4‰ + sanajod 0.06% in L1exp. group and virocide 0.2% + sanajod 0.06% in L2exp. group). The best results have been achieved in the L2exp. group.*

The experiments run during the **II$^{nd}$ experimental** series allowed us to bring forth a few conclusions, presented below:

1. The hen eggs analysed prior to sanitisation revealed a constant microbial contamination, with wide variation limits, being comprised between 31 and 382 germs /cm$^2$.
2. The sensitization actions we run exerted an extremely strong destructive effect, which affected the entire range of microorganisms found on the eggshell. The reduction index, which

accurately reflects this phenomena, was calculated at levels between 97.53 and 100%, depending on the active substance (a.s.) concentration from the decontaminant.

3. The decontaminant used in eggs sanitisation technology - *natrium dichlorideisocyanurate*, in concentrations of 0.2-0.6 g ‰ a.s. reduced the microbial payload from the eggshell, especiialy those concentrations of 4 g ‰ a.s. and 0.6 g ‰ a.s., interrupting the epidemiological chain of the germs.
4. Microbiological exams, revealed in the initial suspensions issued from eggshell surfaces, coliformes germs, staphylococci and filamentous micromycetes. No bacterial strains of *Salmonella* genre have been identified
5. The hatchability proportion was calculated at 92.07 for the Lc2 group (untreated eggs); 92.48 in L3exp. eggs (treatment with *natrium dichlorideisocyanurate 0.6 g ‰ a.s.*); 91.71 in L4exp. group (treatment with *natrium dichlorideisocyanurate 0.4 g ‰ a.s.*) and 89.43 in L5exp. group (treatment with *natrium dichlorideisocyanurate 0.2 g ‰ a.s.*).
6. Consequently, eggs hatching percentage reached 83.03 in Lc2; 84.22 in L3exp.; 85.71 in L4exp. and 80.65 in L5exp. group.
7. Microbial mesophyle flora from the rearing halls presented low values during the first three weeks of life, then explosively increased during the last two weeks, oscillating for bacteria between 357 and 419/$m^3$ of air, respectively between 286 and 376 /$m^3$ of air, for the micromycetes.
8. The microbiological investigations did not revealed *Salmonella* germs in the analyzed samples, while *Staphylococcus* and *Paecillomyces* germs frequently occurred as dominant flora, developing as pure culture sometimes.
9. At slaughtering age (41 days), it resulted that the highest average body weight was found in L4exp. group (2572.64 g) and the lowest one in Lc2 group (2522.40 g). Close to the Lc2 group was situated the L3exp. group (2523.40 g), while the L5exp., with 2558.44 g, was situated closer to the L4exp. group. In percents, the weight gain was higher compared to that measured in Lc2 group (=100), with 1.99 in L4exp. group; with 1.43 in L5exp. and with 0.04 in L3exp.
10. The highest feed conversion ratio value (kg feed/weight gain) was calculated in Lc2 group (1.86), followed in decreasing by L4exp. (1.84), by L5exp. (1.83) respectively bz L3 exp. (1.79).
11. Flock casualties reached 2.23% in Lc2 group; 2.16% in L3exp. group; 1.78% in L4exp. group and 1.96% in L5exp. group.
12. No statistical significance occurred between groups, for the slaughtering efficiency. Thus, in males, the efficiency established on refrigerated meat varied between 66.82% in Lc2 group

and 68.12% in L5exp. group, while in females, from 68.41% in L3exp. till 70.73% in Lc2 group.

13. Weight of internal organs (liver, gizzard and heart) and of carcass trenched parts (breast, thighs and shanks, wings, remnants) had been correlated with the body weight achieved till slaughtering (41 days).
14. Meat/bones ratio in carcasses reached certain values:

- **in males**: 3.03/1 in Lc2 group; 2.81/1 in L3exp. group; 3.16/1 in L4exp. group and 3.11/1 in L5exp. group;

- **in females**: 3.06/1 in Lc2 group; 2.96/1 in L3exp. group; 3.20/1 in L4exp. and L5exp. groups.

The conclusions allowed us to elaborate a few recommendations for the poultry husbandry practice:

- the appliance of eggshell decontamination, using a *natrium dichlorideisocyanurate* solution and the sanitisation technique we designed:

- eggs washing temperature = +32ºC, lasting 2 minutes;

- eggs rinsing temperature = +35ºC, lasting 2 minutes;

- eggs decontamination temperature = +38ºC, lasting 2 minutes;

- environmental temperature = +18… +19ºC.

Among all tried concentrations of *natrium dichlorideisocyanurate*, those of 0.4 g ‰ a.s. (especially) or of 0.6 g ‰ a.s. led to the achievement of best results, both at eggs incubation and rearing of the chickens which hatched from the eggs decontaminated with the studied substance, in the chosen concentrations;

- regularly decontamination of broilers rearing halls is compulsory in order to reduce the development of mesophile aerobe flora, in fact a “sine qua non” conditions required to maintain their health or to achieve high morpho-productive indices;

- the microbial decontamination actions of both eggs and broilers rearing halls are compulsory to be run, knowing that through the significant decreasing or even through the destruction of microbial flora, the incidence of the poultry infectious diseases could be prevented.