

PRODUCTION INDICATORS OF BROILER CHICKENS FATTENING IN THE CIRCUMSTANCES OF A NEW APPROACH TO THE ORGANIZATION AND IMPLEMENTATION OF PREVENTIVE MEASURES ON FARMS IN MONTENEGRO

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Abstract

This research is important because antibiotic resistance has increased worldwide. In addition to indiscriminate and inadequate use in human medicine, one of the reasons for this problem is the administration of antibiotics and other stimulant preparations, both for therapeutic and preventive purposes in veterinary medicine. With this experiment, we tried to prove that through the presented work methods, this use can be reduced and even completely stopped. The goal of this work was to prove that if we provide healthy one-day-old chicks with all the necessary zoohygienic housing conditions, especially microbiologically clean water and food of appropriate quality, we stimulate natural immunity, without the need to give preventive chemo pharmaceuticals.

Around 120,000 chickens, provenance Cobb 500, were fed with adequate feed mixtures. For preventive purposes, experimental chickens were treated with probiotic preparations the "Actiferm" line via drinking water, different from the chickens from the control group where they were administered antibiotics, liposoluble vitamins and other commercial nutritional supplements. During fattening, experimental chickens drank water in which Dioxy activ supra Aqua was dosed, while chickens from the control group drank water without liquid disinfection with this preparation. Investigated parameters were: fattening, vitality, mortality, feed conversion, final weight and EBI index, compared to chickens from the control group. During the fattening period, the number of dead individuals was entered daily in the farm sheets, which keep records of the number status, which at the end of fattening gave us an insight into

the total mortality and final vitality in both groups. Finally, the total consumption of food and water, which is an integral part of the installed equipment, was calculated. The EBI index is calculated according to the universal formula (Average grams gained/day X % survival rate)/Feed Conversion X 10). The chickens were weighed on the slaughter line, which is an integral part of slaughterhouse records. All obtained data were processed using the Microsoft Excel 2010 computer package-arithmetic mean.

Analyzing the obtained results, it can be seen that chickens from the experimental group, unlike the control group, had a 37.7% lower mortality, a 59% higher EBI index, a higher final mass by about 24%, and a lower feed conversion by about 20%. The results show that experimental chickens had better fattening results, in terms of vitality, mortality, feed conversion, and final weight and EBI index, compared to chickens from the control group.

When water begins to be seen as an indispensable part of the daily meal, and not a transporter of chemopharmaceutical preparations, and all the requirements of good manufacturing practice are respected, we come to the conclusion that many preparations, which are given for preventive and therapeutic purposes, are not necessary, but are harmful to both chickens and the humans, consumers of their products.

Key words: Broilers, Drinking water, Biofilm, Liquid disinfection, Stable liquid chlorine dioxide, "Dioxy Activ Supra", "Actiferm".

1. Introduction

The achievement of the expected production results of fattening in healthy broiler chickens is absolutely conditioned by the diet of quantitative and qualitatively sufficient feeding stuffs (starter, grower, and finisher), as well as by supplying appropriate quantities of chemical and hygienic clean drinking water. So, that food and water can be metabolically used, a timely establishment of a specific digestive system is required, and it is preserved function to the end of the fattening [11,16]. The entire digestive tract with its gut-associated lymphoid tissues (GALT) structure is the most important immune complex in chickens [16, 17]. It is clear that the preserved integrity of this organic system will ensure the health assumptions and good production results. Due to short life, high production requirements and specific living conditions, broilers, in comparison with other categories of chickens, are disproportionately exposed to constant stressful influences. As a logical response from their organism, they are more commonly caused by medical disorders, which do not primarily have a specific cause, but are induced by problems of usually abiotic nature. Such problems are inadequate preparation of facilities in the intermittent break, lack or inadequate quality of food and drinking water, problems in the functioning of technological equipment, social problems in the form of overpopulation and other problems. When attached to specific pathogens of parasitic and infectious diseases, which far more strongly express their negative effect in individuals who live shortly and very quickly shift in the same facility, it becomes quite clear that broiler chickens retort various microorganisms and healthily very risky poultry category, permanently requires special attention and medical, technological control.

In Montenegro, mixed objects for fattening broilers dominate, with an input gender ratio of approximately 50 : 50 (50% female and 50% male chickens). In such circumstances, and thanks to the exceptional genetic performance of the dominant provenance of the Cobb 500, the assumptions are that chickens in 42 days of fattening reach a body mass of over 2.5 kg and a total biomass of 32 to 37 tons, in facilities with accommodation capacity of 12,000 to 15,000 one-day individuals, which are dominant in this country [1, 29].

In order to achieve the shown indicators, healthy one-day chickens must remain healthy during fattening. To do this, they must be placed in the clean and disinfected fattening facilities with insured most important micro-ambient parameters (temperature, relative humidity, and sufficient amounts of fresh air). Equipment that maintains the specified parameters in the design values must be functionally flawless and under effective control of operation. In closed accommodation facilities, that are dominant in the broiler production of the Balkan,

the population of chickens per unit area depends on the quality of the micro-ambient parameters, but also on the availability of food and drinking space. In addition, the chickens must be fed with appropriate, quantitative and qualitatively sufficient feeding stuffs, and supplied with chemical and hygiene appropriate quantities of pure drinking water [1, 10, 14, 15, and 29].

Numerous factors influence the desirable consumption of food and water in chickens. The morph-physiological and functional status of the digestive tract is the most important. The process of settling with a desirable saprophytic microflora is crucial for functional status. The digestive tract of the birds contains an extremely rich and diverse microbial population, composed of different microorganisms. Basically, they are bacteria and fungi. In standard living conditions, settling of the digestive tract with an appropriate microflora in young individuals occurs during the first 6 to 12 hours after hatching. Natural inoculates originate from flora of adult individuals, from the environment, or it is a flora of food, and possibly water. Everything is entered into the organism orally or cloacal. Transmission of bacteria, preferably from healthy parents, is performed very efficiently and allows young individuals to form a complete, protective intestinal flora within the first few days of life. In the chickens, 29 bacterial species were identified, and each genus was represented by three to four bacterial species [2, 6, 7, 8, 12, 13]. The settling of the microflora has another very important task - activating the digestive tract, that is, GALT, as the largest immunological organ and the first, most important barrier to preserving chicken health. Immunological segments of the digestive tract are a complex system of immune cells, organized in the lymphatic tissue associated with the mucous membrane of the digestive tube - GAT (gut associated lymph tissue). It consists of disseminated, organized structures such as Peyer's plaques, lymphatic follicles and mesenteric lymph nodes, and lamina-propria cells and intraepithelial lymphocytes [6, 12]. Therefore, the establishment and preservation of the morphofunctional integrity of the digestive tract of chickens is crucial for their health and overall production results [7, 14, 15, and 20].

Hence, the goal of this work was to prove that if we provide healthy one-day-old chicks with all the necessary zoohygienic housing conditions, especially microbiologically clean water and food of appropriate quality, we stimulate natural immunity, without the need to give preventive chemo pharmaceuticals.

2. Materials and Methods

2.1 Materials

The experiments were carried out in production (field) conditions. Cobb 500 breeding chickens were

fattened for eight cycles in four indoor, classic objects, individual usable areas of 960 m². In all of the facilities, Big Dutchman's chicken fattening equipment was fully integrated. Each facility has one control and one experimental cycle - eight in total, in the same four facility.

2.2 Methods

In accordance with the technological norms and the dynamics of migration, the nominal input capacity of each facility is 15,000 one-day individuals in mixed fattening or 35.6 kg/m² of broilers live weight with 42 days of fattening.

These individuals are moved into production facilities as one-day chicks from a foreign reproductive center. Rounded and complete production scheme in each of the four fattening objects was simplified as follows:

- Immigration of one-day not sexed broiler chickens.
- Joint fattening with additional heating of the entire ambient for up to six weeks.
- Emptying the object and preparing for a new cycle of fattening with four sub-phases: extermination, sanitary washing, disinfection and biological rest - up to two weeks.
- New immigration of one-day broiler chickens (new cycle of fattening).

In control treatments, the chickens were moved to objects that were disinfected by formaldehyde (HCHO) steam from a suitable commercial preparation [5]. A commercial hydrogen peroxide product (H₂O₂), as an active component, was used to clean and disinfect the water supply system. Permanent liquid water disinfection during fattening in control chickens facilities has not been performed [22,23].

In experimental treatments, the chickens were moved to objects disinfected using Dioxy Activ Supra Farm disinfectants based on stable liquid chlorine dioxide (ClO₂) as an active ingredient. According to the recommendations of Gagić *et al.*, [9, 10], and in accordance with the instructions for use, this disinfectant is fully used for cleaning and disinfection of the water supply system, as well as in the Aqua variant for permanent liquid disinfection of water during fattening [25].

All chickens were fed by dedicated commercial feeding stuffs (starter, grower and finisher) of adequate hygienic and nutritional quality.

During this period, preventive treatments of experimental chickens were carried out through drinking water four times (during the first three days of life, and then the day before and two days after the vaccination, according to the immunoprophylaxis

program). For these treatments, exclusively probiotic preparations "Actiferm primo" and "Actiferm pro" based on vitamin C, lactose and dextrose's and yeast, were used without the participation of probiotic bacteria [8, 14, 15, and 20]. In the period of six hours before and six hours after the application of the vaccine, the addition of all other means has been stopped in the drinking water. Although the entry hygiene indicators were constantly satisfactory, the liquid disinfection of water was carried out, in accordance with the instructions with the preparation "Dioxy Activ Supra AQUA" in the amount of 1 liter of concentrate per 35,000 liters of drinking water [25]. This disinfectant also contains stable liquid chlorine dioxide (ClO₂) as an active ingredient.

Test chickens have never been treated in any way with antibiotic preparations, liposoluble vitamins, or any commercial nutritional additives that are administered *via* drinking water.

Unlike experimental chickens, control chickens are during fattening, and through the drinking water preventively treated with the following means:

- Antibiotics during the first three days of life and again three days at the end of the second week of fattening.
- Liposoluble vitamins (A, D3, and E) during the first three days of fattening, and after two more occasions for three days, i.e. when switching from one to another mixture or before and after the application of the vaccine.
- Liquid nutritive preparations, similar in composition to the premix, were used at least three times for three days in different stages of fattening, usually three to five days after the application of liposoluble vitamins [26,27,28].

Drinking water was not exposed to continuous liquid disinfection, as its input hygienic indicators, as it was about central water supply (city water supply), were constantly satisfactory.

After cleaning and disinfection, the hygienic status of the surface - floor and wall surfaces, and the area of feeders, as well as the pipes of the water supply system and drinking water at the ends of the pipeline were determined in all facilities.

Quantitative screening controls, which only show the degree of microbiological contamination of the controlled area or media, were performed using ATP luminator and corresponding swabs (Pocket Swab Plus quick ATP swabs). The device is a product of the American company Charm Sciences Inc. [30]. The criteria for determining the zone of sanitary and hygienic purity in accordance with the USA standards were as follows:

- For surfaces, the hygienically acceptable reading value from the used brush is up to 25,000 Relative Light Units (RLU).
- For water, the hygienically acceptable reading value from the used swab is zero (0) RLU.

Daily, weekly and total food and water consumption was monitored by computer. The program is an integral part of feeding and drinking equipment from Big Dutchman [24].

Other health-technological indicators were monitored in accordance with the recommendations of the selectors, as well as the good professional and

production practice of the owners of the facilities in which we conducted the experiments.

3. Results and Discussion

3.1 Results

Obtained results on the hygienic status of the surface of the facility and equipment in it, the water supply system and water in it, in the facilities for both groups of chickens are shown in the Tables 1 and 2. The most important health and technological indicators for both treatments are shown in Tables 3 and 4, and comparative indicators after the treatments in Figure 1.

Table 1. The mean values of the control of the disinfected interior surfaces of the floors and equipment parts with the ATP luminator in the experimental and control treatments (000 RLU) facilities during eight cycles of mixed fattening

Control points	Value of RLU in facilities before sanitary treatment	Mean value of RLU in experimental objects	Mean value of RLU in control objects
Floor in the middle of the object	254.8	19.2	97.6
Wall surface	187.2	11.6	95.5
Surface of feeders	129.4	6.7	72.4

Table 2. The mean values of the control of the sanitary-prepared inner surfaces of the water supply system pipes and water samples with the ATP luminator in objects for the experimental and control treatments (000 RLU) during eight cycles of mixed fattening

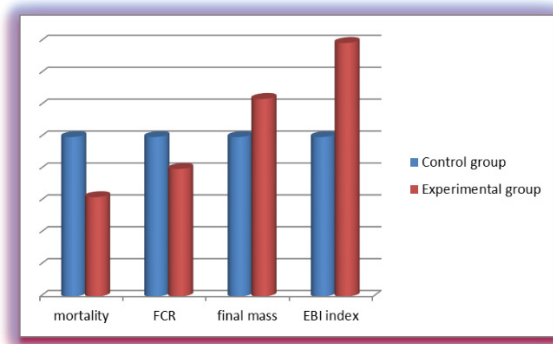
Control points	Value of RLU in facilities before sanitary treatment	Mean value of RLU in experimental objects	Mean value of RLU in control objects
Water at the entrance to the building (n = 8)	0	0	0
Inner tube surface at the end of the system (n = 40)	725,3	23,2	215,6
Water released at the end of the system (n = 40)	295,7	1,7	63,3

Table 3. The most important health and technological indicators for chickens in control treatment

Age in weeks	Number of chickens	Vitality (%)	Individual body weight (g)	Feed consumption (kg)	Water consumption (lit.)
Moved in:	59.997		40.50		
First (1.)	59.675	99,5	166.85		
Second (2.)	59.285	98,8	427.15		
Third (3.)	59.096	98,5	818.65		
Fourth (4.)	58.492	97,5	1.330,00		
Fifth (5.)	58.186	96,9	1.822,00		
Sixth (6.)	55.846	93,1	2.092,00		
Cumulative consumption				234.480	473.080
Food water relationship				1	2,02
Mortality in fattening		6,9%			
Final live weight of chickens			116.829,83 kg		
FCR			1	2.01	
EBI	230.07				

Table 4. The most important health and technology indicators for chickens in experimental treatment

Age in weeks	Number of chickens	Vitality (%)	Individual body weight (g)	Feed consumption (kg)	Water consumption (lit.)
Moved in:	58.959		40,60		
First (1.)	58.133	98.6	176.67		
Second (2.)	57.760	98.0	467.17		
Third (3.)	57.501	97.5	953.00		
Fourth (4.)	57.234	97.1	1.577.30		
Fifth (5.)	56.818	96.4	2.173.00		
Sixth (6.)	56.402	95.7	2.591.00		
Cumulative consumption				234.760	493.458
Food water relationship				1	2.10
Mortality in fattening		4.3%			
Final live weight of chickens			146.137,60 kg		
FCR			1	1.61	
EBI	366.68				

**Figure 1. The most important health and technological indicators for chickens in control treatment**

3.2 Discussion

The concept of broiler production is based on the assumption that healthy chickens, during the fattening period will, in the prescribed time, eat the anticipated quantities of intended foods and drink double amount of chemicaly and hygienicly clean water in an approximate way, only if we provide them with optimal accommodation, feeding and drinking space. In doing so, it will reach the planned body mass and achieve the correct conversion of food, which is otherwise the most expensive input in the production of broiler meat. For all these expectations, the integrity and optimal function of the digestive tract is absolutely necessary. In modern broiler production, it is precisely at this point that the problems begin, with the integrity and functionality of the digestive tract of chickens. By organizing and implementing preventive measures, which from the first day of chicks life predict the application of problematic preparations, among which are almost always wide-spectrum antibiotics,

that undermine the integrity and functionality of the digestive tract of chickens.

How to explain the purpose of early "preventive" treatment with antibiotics from the first day of life, when it is a period of intensive housing of digestive microflora? How to explain the justification of giving liposoluble vitamins through drinking water, when they are soluble in fat, and in addition, they should be sufficient in foods that chickens eat? How to ignore the fact that such a preventive approach, other than perhaps commercial, does not have other professionally justified reasons? On the contrary, a whole series of contra-arguments can completely be called into question by the current, dominant concept of prophylaxis of fattening. First, it is difficult to expect that the process of settling the digestive microflora will be successful when it is disturb with given wide-spectrum antibiotics. Consequently, the digestion function will be slowed down or delayed. Since antibiotics, because of restrictive EU directives, are not used in food than in drinking water, a reasonable question is raised about the quality of such drinking water, an extremely important, if not the most important nutrient, which constitutes 2/3 of the day's chicken meal. This has been previously known and presented in the results of our research (Ališah *et al.*, [1], Gagić *et al.*, [9, 10], and Vraneš and Leskovar [21]), that the load of drinking water by various, inappropriate preventive means results in the change of its organoleptic properties and the rapid development of biofilm formations on the inner surfaces of water supply tubes [3,18]. These formations occur within a period of 96 hours to two weeks, making them an inorganic - organic matrix, with mainly ambient bacterial species at different stages of maturity and antibiotic resistance. What is

the frequency of given antibiotic through drinking water more often, the extent of resistance is manifest, and the increase in the pathogenicity of "ordinary" saprophytic microorganisms.

Due to this concept of prophylaxis and insufficiently effective means for the actual removal of biofilm formations from water supply system, young broiler chickens with cocktail of preventive agents have the opportunity to gain and highly resistant and for them already pathogenic microorganisms from their predecessors. Their presence in bacteriological controls and autopsy searches of dead bodies will only provide an additional alibi for translating preventive treatments into antibiotic therapies. And it will be rare to wonder where, for example, colisepticemia is the most common finding in the suspected samples of diagnostic material. If non-specific health problems in the flock do not escalate at the beginning of the fattening, antibiotic treatments will mask health problems and slow the chicken's death until the first stressful situation. In the standard circumstances of production technology implementation, such situations coincide either with the application of vaccines or with the change of food, which happens during the second, third and even fourth week of life. Then, due to initial errors in early prevention, the consequences of metabolic incompetence of the digestive tract, the consequences of GALT immunosuppression, the consequences of the action of microorganisms from biofilm, the consequences of insufficient water consumption, poor food utilization, poor growth and growth, increase the morbidity and mortality of chickens.

From the results of our research (Tables 1 to 4), it is evident that conventional preparation of facilities, equipment and water supply systems did not result in satisfactory hygienic status of surfaces and media [5]. with which one-day chicks come into contact immediately after moving into objects. Probably because of that, early contacts take place with numerous environmental micro-organisms, which might be useful, that these effects have not been canceled by treatments with given antibiotics. Antibiotics slow down the settling and optimal distribution of microflora in the digestive tract, which biologically establishes a relative "status quo" in the organism of initially healthy chickens. Therefore, the dying are reduced during the first ten days of life, our until real escalation caused by stress occurs. If chickens are of poor quality, despite the treatment they take, they begin to die, right after immigration and can get very large proportions. If chickens are poor in quality, despite the treatment they take, start to dying practically immediately after the migration and that can get very serious proportions. On the other hand, from the results of experimental

treatments, it is noticeable that the preparation of facilities, water supply system, equipment and water disinfectants of the "Dioxy Activ Supra" line resulted in their very good hygienic status [4,19]. Therefore, one-day chickens started their lives in a hygienically correct environment, and the included preventive treatments supported the most important life activities. In this context, somewhat larger dying of chickens at the beginning of the fattening can be interpreted as the expected selection of the worse and for the life unprepared individuals. Dying in the later period of fattening, contrary to chickens from control group, reduced within or below technologically acceptable limits. Chickens from the beginning drink pure hygienic drinking water, without insoluble or difficult soluble substances in it. This greatly slows down the formation of biofilm formations in the water supply system, and increases the desirable consumption of water by chickens. Adding probiotics of the Actiferm line, which containing water-soluble vitamin C, lactose and galactose with active yeast, prevents stress and supports the settlement and optimal distribution of the microflora of the digestive tract, while preserving its overall integrity. Confirmation of these allegations are comparative results in two treatments - control and experimental, shown in Figure 1. Only by changing the concept of prophylaxis of fattening, in almost the same number of chickens, in the same number of fattening cycles realized in the same objects, with chickens of the same provenance and the same origin, we have identified significantly better all relevant health and technology parameters - vitality, body weight, consumption and food conversion, and EBI index as an indicator of the financial success of fattening.

4. Conclusions

The achieved results of our research at the same length of broiler chick feeding, in both treatments, make it possible to carry out the following conclusions:

- In relation to conventional disinfectants, the disinfectants of the "Dioxy Activ Supra" line have been successfully applied for preventive disinfection in the intercourse pause, for disinfection of the water supply system and especially for permanent, liquid disinfection of drinking water during broiler chickens fattening.
- In the standard circumstances of the implementation of production technology with healthy chickens and nutritionally adequate feeding stuffs, the hygienic correct water supply of experimental chickens completely reduced the need, the established preventive action in control chickens, which implies the application of various vitamins, nutrients and antibiotics through drinking water.
- In such circumstances, chickens from experimental treatment were preventively triple treated only with

probiotics of the "Actiferm" line during four cycles, and they achieved better all relevant indicators of fattening success, 38% lower mortality, 24% higher terminal weight, 20% better conversion of food, and a 59% higher EBI index than chickens from control treatments.

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