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THE EFFECTS OF VARIOUS ORGANIC ACIDS ON GROW PERFORMANCE AND GUT MICROBIOTA OF BROILER CHICKENS

Malancea Nicolae nicumalancea@gmail.com

Technical University of Moldova

Relevance. There is a tendency to optimize antibiotic use, including in broiler chickens rearing, due to concerns about antibiotic resistance in humans and production animals. To satisfy these requirements, the industry must maintain the lowest pathogenic pressure in the chicken's farms, allowing production of chicken meat without or with minimal use of antibiotics.

Meat consumption in the Republic of Moldova is constantly increasing. Thus, if in 2008, a person consumed, on average, 30.7 kg of meat annually, then in 2019 this figure amounted to 52.8 kg of meat.

Chicken gut microbiota have a strong relationship with the health and productivity of broiler chickens, thus organic acids acquired importance as a result of their excellent nutritional content and antibacterial benefits by reducing colonization of pathogenic bacteria and involvement in digestive processes like nutrient digestion and absorption.

During the last 5 years on the veterinary pharmaceutical market in the Republic of Moldova appeared different types of organic acids for chickens, which can be administered through water or feed. Nowadays broiler chicken's farmers have the option to replace antibiotics, which was the only way to control bacterial infections in chickens, with alternatives like acidifiers. Also because of the increased demand for antibiotic free and organic chicken's products, farmers are interested in finding new alternatives for controlling bacterial infections in poultry.

Organic acids can benefit poultry internally by their ability to lower the pH of the gastrointestinal tract. It has been found that organic acids such as fumaric, propionic, lactic, and sorbic acid have the ability to reduce the colonization of pathogenic bacteria and the production of toxic metabolites through acidification of the diet [1]

Water is the most important nutrient for the overall health and performance of birds. Water intake of poultry is approximately twice that of the intake of feeds [2].

The inclusion of organic acids in poultry diets can improve gut health, increase endogenous digestive enzyme secretion and activity, and improve nutrient digestibility. Thus, they generally contribute to the overall gut health of the animal. Organic acids are also used in drinking water to help lower the microbial count [3].

The aim of this study was to evaluate the influence of organic acids, administered through the drinking water, on growth performance and controlling bacterial infections of broiler chickens as an alternative for antibiotics.

Figure nr. 1 group of chickens from study

Materials and methods. In this study was used 3 commercial water acidifiers for chickens, available for sale in Republic of Moldova, with different composition:

1. Agrocid Super Oligo (CID LINES, Belgium) composition: lactic acid, formic acid, propionic acid, sorbic acid, citric acid, zinc, copper, sugar and salt. Contains natural copper and zinc for better absorption and feed conversion.
2. Novion SL (Innovad, Belgium) composition : propionic acid, formic acid, lactic acid, butyric acid, medium chain fatty acid, essential oils, propylene glycol. Essential oils damage the bacterial cell wall and make it more permeable to organic acids and medium chain fatty acids and butyric acid can penetrate the capsule and wall of bacteria.
3. Noack Ac Bil (FF Chemicals, Holland), composition: formic acid, ammonium formate, Propionic acid.

The research was carried out on broiler chickens, the hybrid Ros-308, during 42 days. A total of 40 chickens were divided by ten in each group, where one group was designated as the control group. Control group received regular water and treated groups received organic acids in the water according to the manufacturer's instructions, the target water pH was between 4,5-5.

During the study chickens had free access water and feed, temperature and light were controlled according to management guide, also the chickens were permanently examined clinically and all data were recorded relating to body weight (BW) and feed consumption, on day 14, day 28, and day 42 to calculate average daily gain (ADG), average daily feed intake (ADFI), and feed conversion ratio (FCR) and mortality for each feeding phase.

Furthermore, the cloacal swabs were collected for laboratory investigations in order to determine the presence of Gram negative bacteria in the gut. All samples were incubated in enrichment buffered peptone water for 24 h at 37°C. Subsequently, a loop-full of culture from buffered peptone water enrichment broth was inoculated on MacConkey lactose agar culture medium (HiMedia, India) and incubated at 37°C for 24 h. Isolated dark pink colonies were further picked and subcultured on Eosin Methylene Blue agar (HiMedia, India) and incubated for 24 h at 37°C. Suspected E. coli colonies were then transferred on Kligler iron agar (HiMedia, India) for further characterization and confirmation such as positive glucose/lactose fermentation, gas production and absence of H2S production.

Results. The results of chickens' growth performance starting from day one until slaughtering are shown in Table 1. In the starter phase, the control group had a lower FCR (feed conversion ratio) compared to the chickens with supplemented water. During the whole study period, the control group tended to have a lower body gain compared to the chickens with acidified water, through chickens groups supplemented with organic acids, the lower grow performance of broiler chickens supplemented with organic acids was in Noack (2930 g final body weight) compared with Novion (3010 g final body weight) which shows the best performance, and all the 3 groups with acidifiers had lower feed conversion ratio (FCR) compared to the control group.

Table 1. Effects of organic acids on growth performance parameters of broiler chickens during whole period of rearing, body weight (BW), average gain (AG, g/day), average feed intake (AFI, g/day) and feed conversion ratio (FCR, g/d)

Starter (1-14 days)				
	Control	**Agrocid**	**Novion**	**Noack**
BW (g)	415	427	430	420
ADG	26,15	26,53	26,87	26,32
ADFI	35,3	36.5	37,12	36
FCR	1.4	1.37	1.34	1.39
Grower (15-28 days)				
BW (g)	1390	1482	1520	1465
ADG	72.3	77.5	78	77.2
ADFI	120	123	122	119
FCR	1.62	1.57	1.52	1.59

Finisher (29-42 days)				
BW (g)	2900	2952	3010	2930
ADG	109	117	119.3	110.5
ADFI	181	185	189	183.5
FCR	1.72	1.59	1.56	1.63

The results revealed that chickens that did not receive organic acids were colonized with more potential harmful gram negative bacterial strains, such as E.coli and Salmonella, compared with experimental groups (*figure nr.2*). The water with acidifiers influenced not only the diversity of bacteria but also the amount of bacteria in the chickens' gut. Also, the acidifiers improved the growth of beneficial bacterial species such as Lactobacillus spp., Bifidobacteria spp., Bacteroides spp. and Bacillus spp (*figure nr.3*).

Figure nr. 2 **Bacterial examination of cloacal swabs in chickens supplemented with acidifiers and control group (last petri dishes)**

Figure nr 3. **Kligler iron agar medium for E.coli confirmation**

Conclusions

The study demonstrates the importance of using organic acids as water additives to improve the growth performance of broilers, because of their physiological action in inducing growth and through their beneficial antimicrobial effect. The administration of the water supplemented with organic acids gives a higher body weight in chickens from the experimental group compared to chickens from the control group.

Water acidifiers have improved performance, including morbidity, feed conversion rate, body weight gain and reduction of Enterobacteriaceae compared to birds with untreated water.

Therefore, the supplementation of water with organic acids could be an effective strategy to replace antibiotics used for prevention and treatment of bacterial infections in broiler chickens. Also, the organic acids can be used, together with the complex of sanitary-veterinary measures, for the biosecurity strategy of preventing meat infestation with pathogenic bacteria.

Reference

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