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INFLUENCE OF CATHOLYTE ON SLAUGHTER PARAMETERS IN DUCKS

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ABSTRACT

Electro-activated (dissociated) water (EAW) has been growing in popularity in recent years in many countries. It is used as a cleaning agent and disinfectant in the food industry, as well as a disinfectant of river water used as drinking water for animals.

Catholyte has a beneficial effect on productivity and some physiological parameters, and is a cheap, safe, non-toxic and effective option for improving the overall production parameters in mammals and birds.

In the present study, the effect of catholyte on some carcass parameters in White Pekin duck was examined. Live weight, weight of fresh eviscerated carcass, weight of feathers and blood, head, legs, intestines, gizzard, heart, spleen and liver were measured. The results showed an increase in the carcass weight of the experimental group of ducks, drinking catholyte, compared to the control group – drinking tap water. There was also an increase in the weight of the head, legs, feathers and blood, and all the internal organs of the experimental group of birds, compared to the control group, except for the gizzards. The use of catholyte does not affect significantly the yield of the carcass.

Key words: Electro-activated (dissociated) water, catholyte, slaughter parameters, yield, ducks.

Introduction

Electro-activated (dissociated) water (EAW) is a new trend in nanotechnology. It was originally studied by Shimizu and Hurusawa (1992) in Japan, who described its bactericidal properties useful in the food industry. Hricova et al. (2008) note the apparent growing popularity of EAW as a cleaning agent used in the food industry in many countries.

Hsu (2005) gives a general description of an EAW generating device. It consists of a cylinder in which water is placed and two electrodes under direct electric current. Positive and negative ions pass through a semipermeable membrane separating the two electrodes. A different solution forms around each electrode. The anode produces an anolyte with a pH of 2.3–2.7 and a high (above 1000 mV) oxidation-reduction potential (ORP) containing free chlorine ions. At the other electrode, the cathode produces a catholyte with a pH of 10.0 – 11.5 and a very low ORP (-800 to -900 mV) containing dissolved hydrogen.

McPherson (1993) argues that the ORP value can cause changes in the metabolic processes and ATP production, as well as likely to affect the electronic flow in cells. According to Marriott and Gravani (2006), the presence of chlorine can disrupt protein synthesis, oxidative decarboxylation of amino acids to aldehydes and nitrites, and cause metabolic imbalances after the destruction of key enzymes in microorganisms.

Cloete (2015) investigated the use of catholyte and anolyte in various concentrations as a disinfectant in a poultry slaughterhouse during scalding and water cooling, as well as by spraying chicken carcasses before and after evisceration. Anolyte solution in 1:10 dilution gives the best results in all forms of application. The use of catholyte does not give similar results. On the contrary, the author believes that catholyte can disperse bacteria during scalding without killing them, leading to higher levels of contamination.

Holcroft (2003) studied the effect of anolyte as a means of decontamination of river water used as a drinking water in broiler chickens. The results show 100% killing of the tested bacteria and a significant improvement in live weight in birds using water with the addition of 15% anolyte.

Shihab et al. (2019) prove that watering Japanese quails (Coturnix japonica) with ionized (alkaline or acidic) water has a beneficial effect on productivity and some physiological indicators, and is a cheap, safe, non-toxic and effective option for improving overall production parameters. The use of ionized water with pH 8 or 9 leads to the best quality of eggs, optimal levels of lipid profile and blood parameters. All experimental birds watered with ionized water have a significantly higher average weight of eggs, as the group of quails watered with alkaline water with pH 9 is characterized by higher average egg production, weekly laying productivity and total number of eggs.

A study by Adamec et al. (2011) in an industrial pig farm showed that the addition of 8% anolyte (with pH below 3) to pig rations had a positive effect on growth and resulted in a 4% weight gain. The assessment of the quality of the meat of these pigs after slaughter shows the absence of potentially negative effects of EAW on meat parameters. Experiment with broiler chickens gives similar data on the quality of meat, with differences in some criteria are insignificant.

The shown above, as well as the lack of research in this direction, led us to aim to study the influence of EAW in the form of catholyte on some carcass indicators in white Pekin duck.

Materials and methods

Birds and housing

The study was conducted with 20 female ducks of the White Pekin Duck breed from parents: mother – White Pekin Duck (*Anas platyrhinhos*), father – White Pekin Duck and Muscovy duck (*Cairina moschata*). The ducks were obtained at 8 weeks of age (56 days of age) from a farm for mother flocks in the country. They were divided into two groups of 10 ducks – experimental (E) and control (C) group. The birds were distributed and equalized in each group by the average live weight of a bird. The ducks from each group were divided into three cages, and separated respectively by 4; 3; 3 birds in a cage. In the experiment, the birds were distributed and equalized by the average live weight of a bird in each group. The average live weight of a bird at delivery in the experimental group was 1.6360 ± 0.0918 kg, and in the control group – 1.6902 ± 0.1020 kg. There was a predominance of 0.0542 kg average live weight of a bird in the control group, which is not a statistically significant difference ($P > 0,05$).

During the experiment, the ducks were raised outdoors, with the cages placed under canopies. All zoohygienic requirements for area and ethical norms for work with experimental animals were met in accordance with Veterinary law (2006), Animal protection law (2008) and Directive 2010/63/EU on the protection of animals used for scientific purposes. (The permit for using animals for scientific purposes is entered in the register of the BFSA with registration № 277 and is valid until 20.07.2025).

Feeding programme and diets

The experiment was performed within 1 month (from 56 to 86 days of age). During this time, the birds had free access (*ad libitum*) to water and feed.

Both groups of ducks were fed with compound feed for ducklings – Grower (8–9 weeks of age), production of Bulgarian Feed Company (ID. № αBG2230075), with the following content: *wheat – 20%, corn – 50%, sunflower meal – 6.55%, soybean meal – 17%, sunflower oil – 1%, monocalcium phosphate – 1.1%, calcium carbonate – 1.1%, sodium chloride – 0.25% and bran –*

3%. The chemical composition, energy value, content of minerals and amino acids in 1 kg of feed are as follows: *crude protein – 16.8%, crude fat – 4.6%, crude fiber – 4.1%, crude ash – 5.3%, calcium – 1.1%, phosphorus – 0.6%, sodium – 0.1%, lysine – 1.0%, methionine – 0.5%, metabolic energy – 3060 kcal/kg, iron – 98 mg/kg, copper – 6.4 mg/kg, zinc – 32 mg/kg, manganese – 23 mg/kg, iodine – 0.03 mg/kg, selenium – 0.02 mg/kg.*

The experimental group of ducks were watered only with catholyte (electroactivated drinking tap water obtained by activation on the 3rd degree with water ionizer – Aschbach – ionisiertes Wasser) with pH 9,29, ORP -139. The catholyte was produced daily immediately before each loading of the drinkers. The control group was watered only with tap water with pH 7. In both groups of birds, non-metallic polypropylene drinkers were used to comply with the requirement that the catholyte cannot come into contact with a metal surface, as the metal inactivates it.

In the middle of the experimental period (15^{th} day), due to the loss of 2 birds from the control group, due to trauma to the legs (respectively heel and tarso-metatarsal joint), regrouping of animals in the cages was performed. In order to equalize the number of birds in the groups, 2 birds from the experimental group were excluded from the experiment. The excluded birds were selected so that they were equal in weight to the discarded ones. Thus, in the experimental and control group remained 8 birds respectively, which were redistributed into 2 cages with 4 ducks each, to equalize the stocking density.

Access to feed was suspended 24 hours before slaughter, during which time access to water was not restricted.

Carcass characteristics

At the end of the experiment (at 86 days of age), all ducks were individually weighed.

All ducks were mechanically stunned by a sharp blow to the head with a wooden club, then immediately were slaughtered by cutting the blood vessels in the neck and bled in a vertical position, according to the requirements of Council Regulation (EC) No 1099/2009 on the protection of animals at the time of killing.

The slaughter and processing of the birds were according to the technological norms of BDS 14592-78 (1). They were steamed in a hot water bath (65°C) for 3–5 minutes and the feathers were removed by hand. The finest down feathers were additionally removed by burning (scorching) the carcass with propane butane burner, followed by showering the outer surface of the carcass. After draining, the weight of all carcasses was measured individually (after slaughter, bleeding and defeathering). Immediately afterwards, the head and legs of each bird were removed from the carcass, after which the birds were eviscerated. During evisceration, the digestive tract and other internal organs were removed from the body cavity. The lungs and kidneys were not separated from the carcass. The weight of the separated parts – head, legs, intestines, gizzard, heart, spleen and liver (after removal of the gallbladder) were individually measured for each bird. The weight of the fresh eviscerated carcass was also measured. The yield of the fresh eviscerated carcass in relation to the live weight of the birds, was calculated as a percentage.

For the weight measurements a precise scale was used: KERN® PCB 6000-1 (KERN & SOHN GmbH Ziegelei, Balingen, Germany) with a range of up to 6000 grams, with an accuracy of 0.1 g.

Statistical analysis

The results were processed mathematically, finding the average value (AV) and standard deviation (SD). To test the statistical dependence and reliability of the results, a Student's t-test analysis for independent samples was applied. Significance of results was defined at significance level P <

0.05. *Microsoft ®Office Professional Plus Excel 2013 (15.0.4569.1506)* was used for the calculations.

Results and discussion

The results obtained from the individual measurement of the indicators live weight, weight of the carcass after slaughter, after bleeding, defeathering and draining, also the weight of the head, legs, intestines, gizzard, heart, spleen, liver (after removing of the gallbladder) and the weight of the fresh eviscerated carcass, in all slaughtered ducks from the experimental and control groups are presented in Table 1

After excluding from the calculations the ducks dropped out during the experiment, the average live weight of a bird at the beginning of the experiment in the experimental group was 1.6261 ± 0.0930 kg, and in the control group – 1.7065 ± 0.0964 kg. There was a predominance of 0.0804 kg average live weight of a bird in the control group. At the end of the experiment, the average values of live weight showed a predominance of 0.1208 kg in favor of the experimental group. The experimental group started the experiment with a lower average live weight and ended with a higher one. The formed difference of 0.2012 kg in the growth of the experimental group is significantly higher ($P < 0.05$) compared to the growth of the control.

There is a difference of 0.0798 kg in the average weight of the carcass after slaughter and defeathering, which is also in favor of the experimental group. There are similar differences in favor of the experimental group in the other measured slaughter indicators: weight of the head – 0.0040 kg, legs – 0.0029 kg, intestines – 0.0143 kg, heart – 0.005 kg, spleen – 0.0001 kg, liver – 0.0030 kg and the weight of the fresh eviscerated carcass – 0.0536 kg. This confirms the results obtained for growth, although the differences here are not statistically significant. Only in the gizzards there is a predominance in the average weight – 0.0021 kg in favor of the control group.

There was also a statistically significant difference ($P<0.05$) in favor of the experimental group in the average weight of blood and feathers. This may be due to the diluting effect of catholyte on the blood when taken *per os*. In support of this, Dr. Irlacher's studies in Germany on the effects of "live" water on blood properties show that the use of "live" water prevents blood clotting (Ashbakh, 2008).

The yield in the experimental group of ducks was 70.25%, compared to 71.38% for the control. This insignificant difference is due to the uniform growth of all parts of the carcass of the experimental group, compared to the control, except for the gizzards. The greater "losses" from the blood and feathers of the experimental group of ducks probably have an impact as well.

Conclusion

The results show that electro-activated water taken in the form of catholyte for one month as the only drinking water for ducks at 8 weeks of age, has proven to have positive effect on the growth and live weight of the birds. The administration of catholyte *per os* has a positive effect on the slaughter parameters of ducks – it increases the weight of the carcass, blood and feathers, head, legs, intestines, heart, spleen and liver. The use of catholyte does not significantly affect the yield of the carcass.

Table 1: Live weight and slaughter parameters of the experimental and control group of ducks.

GROUP	Indicator	Live Weight [kg]	Weight After Slaugh-ter [kg]	Blood and Feathers [kg]	Head [kg]	Legs [kg]	Intes-tines [kg]	Gizzard [kg]	Heart [kg]	Spleen [kg]	Liver [kg]	Fresh Eviscer-ated Carcass [kg]
EXPERIMENTAL	AV	2,8809	2,5453	0,3356*	0,1166	0,0637	0,1656	0,0777	0,0203	0,0014	0,0521	2,0239
	SD	0,1659	0,1483	0,0394	0,0060	0,0054	0,0117	0,0197	0,0020	0,0003	0,0044	0,1164
CONTROL	AV	2,7601	2,4655	0,2946*	0,1125	0,0608	0,1513	0,0797	0,0198	0,0014	0,0491	1,9702
	SD	0,1254	0,1218	0,0341	0,0044	0,0031	0,0151	0,0094	0,0016	0,0003	0,0060	0,1013
SIGNIFICANCE		NS	NS	*	NS	NS	NS	NS	NS	NS	NS	NS

Legend: *Differences between averages in groups within columns:* ***** *Significant (P<0,05);* **NS –** *Not significant (P>0,05);* **AV** *– Average;* **SD** *– Standard Deviation.*

Recommendation

The use of electro-activated water in the form of catholyte as the only drinking water immediately after hatching and throughout the fattening period could lead to a significant improvement in the slaughter parameters of ducks.

All this, as well as the effect of the application of electro-activated water *per os* on other animal species remains to be studied.

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