

Evaluation of the growth performance and some blood parameters in broilers with the addition of humic substances in the diet

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The effect of the administration of two humic preparations on a selected production and biochemical parameters were monitored in an experiment with broiler chickens of the Cobb 500 breed. There were not observed statistically significant differences between the control group and the experimental groups in the achieved average live weight and the feed conversion ratio in the 37-day experiment. The statistically significant differences ($P < 0.001$ and $P < 0.05$) were between the content of calcium, phosphorus and chlorides in the blood of the control group compared to the experimental groups. As for magnesium in the blood, we did not find significant differences ($P \geq 0.05$) between the groups. As far as the parameters of the energy profile are concerned, the content of glucose and cholesterol was statistically significantly higher in the control group in comparison with the experimental groups ($P < 0.05$). The concentrations of triglycerides were statistically significantly higher in the experimental groups ($P \leq 0.05$, resp. 0.01, resp. 0.001) compared to the control group.

Keywords: nutrition, humic substances, production, blood, broilers

1 Introduction

Humic substances are a class of compounds resulting from the decomposition of organic matter. Many studies have showed their capacity to inhibit bacterial growth, improve the immune system, antiviral properties, as well as to prevent and care intestinal disorders, improve the nutritive value of feed and trace element utilisation, with positive effects on growth performance and a reduction in mortality (Nagaraju et al., 2014; Mudroňová et al., 2020). The use of humic substances in animal nutrition has been a topic of many trials with ruminants (Majewska et al., 2017; El-Zaiat et al., 2018; Terry et al., 2018), pigs (Wang et al., 2008) rabbits (Rzasa et al., 2014) and poultry (Yoruk et al., 2004; Avci et al., 2007; Pistová et al., 2017).

The aim of this work was to evaluate the effect of two humic preparations added to feed in the same concentration (0.7%) on production efficiency and selected blood parameters in broiler chickens of the Cobb 500 breed.

2 Material and methods

2.1 Animals and diets

The trial was performed with 90 one-day-old Cobb 500 breed broiler chickens up to 37 days of age, which was the age of slaughter. The chickens, with average live weight 47 g/chicken, were divided into three groups of 30 animals each. The experiment was carried out in a certified breeding facility (Register No. 230723). The broilers were fed with commercial feed mixtures HYD-01 (starter), HYD-02 (grower) and HYD-03 (finisher). The chemical composition of diets

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was determined for dry matter, crude protein, crude fat, crude fibre, starch, calcium and total phosphorus according to the EC Commission Regulation 152/2009. The value of metabolisable energy in diets was calculated with the formula according to the EC Commission Regulation (2009). The nutrient contents of the control and two experimental feed mixtures are shown in Table 1. The control group (C) was fed with the feed mixture without additive. The first experimental group (HN) received the feed mixture with the addition of the humic preparation (HUMAC®Natur AFM; Humacs.r.o., Slovak Republic) at a concentration of 0.7%.

The feed mixture with the addition of the humic preparation at the concentration 0.7%, containing formic acid (HUMAC®Natur AFM Monogastric; Humacs.r.o., Slovak Republic), was used for the second experimental group (HM). Broilers were fed *ad libitum* with free access to water.

2.2 Analysis

The live weight of broiler chickens was measured at weekly intervals and the mortality was monitored. The feed consumption was weighted and the average daily feed consumption of one bird, the average daily weight gain and the feed conversion ratio were calculated. The chickens were humanely slaughtered on day 37. The blood samples ($n = 12$ from each group) were examined for selected parameters of mineral and energetic profile with the apparatus ELIPSE (AMS, Italy).

2.3 Statistical methods

The data were expressed as means \pm standard deviation (SD) of single values (IBM SPSS Statistics, Version 24). Results were statistically compared by Tukey-Kramer multiple comparison test. Significance was declared at level below $P < 0.05$.

3 Results and discussion

The effects of the addition of two preparations of humic substances on the production parameter and selected biochemical markers in the blood of experimental animals were studied in the experiment with the broiler chickens. The nutrient concentrations were laboratory determined and the energetic value was calculated in the used feed mixtures. The results are demonstrated in Table 1.

Table 1 Nutrient contents of the complete feed mixtures in the control group and in the experimental groups (g/kg dry matter basis)

	HYD1	HYD1 + HN	HYD1 + HM	HYD2	HYD2 + HN	HYD2 + HM	HYD3	HYD3 + HN	HYD3 + HM
CP	230.0	225.8	225.1	222.0	220.0	218.3	207.1	207.7	207.9
Ash	57.3	64.7	68.8	60.6	61.2	63.2	47.2	49.8	51.8
EE	31.3	32.6	33.2	83.8	81.9	84.1	52.2	51.2	52.8
CF	35.3	37.8	37.1	39.5	48.9	55.0	49.8	51.1	49.1
Ca	5.9	6.1	5.9	6.0	7.92	8.5	7.6	7.9	8.8
P	5.7	5.9	6.6	7.9	8.94	9.0	5.1	5.1	6.3
ME (MJ/kg)	13.26	13.09	12.96	14.29	14.00	14.18	13.21	13.43	13.58

HYD1 – feed mixture to 10 days; HYD2 – feed mixture 11–32 days; HYD3 – feed mixture 33–37 days; HN – Humac®Natur; HM – Humac®Natur Monogastric; CP – crude protein; EE – ether extract; CF – crude fiber; Ca – calcium; P – phosphorus; ME – metabolizable energy

According to the determined contents of crude protein (CP), ether extract (EE), ash, crude fiber (CF), calcium (Ca), phosphorus (P) and metabolisable energy (ME) values, it can be stated that the feed mixtures were within the tolerance and in line with the required content in all phases of the experiment.

There were not observed the non-standard behaviour of broilers (lethargy, diarrhea) during the experiment. The mortality of two chickens in the HM group and one chicken in the control group were observed in the first week of the experiment. The chickens with a significant decrease in the growth rate were excluded from the experiment in the third week after weighing from the control group one, from the HM group one and three chickens from the HN group.

On the contrary to the findings of some authors (Vaško et al., 2012; Arpašová et al., 2016), there were not registered any positive effect on the mortality in our experiment with the used humic preparations in used concentrations.

We measured the highest average live weight (2,326.6 g/bird) of broilers in the HM group, the value of this parameter was lower by 14.7 g in the HN group and the lowest value was observed in the control group (2,291.7 g) on day 35 of experiment. These differences between groups were not statistically significant.

The statistically insignificant differences were registered in the feed conversion coefficient between the control group (1.51) and the groups with the feed addition of humic preparations (HN – 1.65; HM – 1.63). The average feed conversion ratio was affected by a significant deterioration of the feed conversion in the experimental groups in the last week of the experiment (HN – 2.05, HM – 1.91) compared to the control group with the value of 1.71.

Table 2 Daily weight gain (g), live weight (g), feed consumption (g) and feed conversion ratios of broilers during experimental period

Group\Week	1.	2.	3.	4.	5.	Average
Average daily weight gain						
C	21.80	45.22	64.62	92.49	94.11	63.64
HN	20.32	43.84	59.97	86.92	87.82	59.77
HM	18.45	46.28	64.95	92.89	98.56	64.22
Average live weight						
C	191.7	514.8	985.5	1,633.0	2,291.7	
HN	182.1	488.9	963.1	1,571.5	2,311.9	
HM	188.8	512.8	986.4	1,636.6	2,326.6	
Average daily feed consumption						
C	27.9	63.6	106.1	140.8	156.6	
HN	28.1	60.4	105.8	147.1	167.2	
HM	27.3	66.5	112.2	152.4	188.4	
Feed conversion ratio						
C	1.28	1.40	1.64	1.52	1.71	1.51
HN	1.38	1.37	1.76	1.69	2.05	1.65
HM	1.48	1.43	1.72	1.64	1.91	1.63

C – control group (n=28); HN – group 0.7% humic supplement Natur (n = 27); HM – group 0.7% humic supplement Monogastric (n =27)

The calcium content in the blood of broiler chickens was below the reference value in all groups. The average content of calcium (1.98 mmol/l) in the control group was closely below the lower limit of the reference range. As for the experimental groups with the intake of humic preparations, the concentration of Ca in the blood was statistically significantly lower ($P < 0.001$) compared to the control group. The significantly lower ($P < 0.001$, resp. $P < 0.05$) concentrations were also found for the content of phosphorus and chlorides in the blood in the experimental groups compared to the control. The concentration of magnesium was not statistically significantly different ($P \geq 0.05$) among groups (Table 3).

Table 3 Content of calcium, phosphorus, magnesium and chlorides in the blood of broilers (mmol/l)

		C	HN	HM	
Ca	mean	1.98 ±0.08	1.19 ±0,2	1.42 ±0,17	C : HN***; C : HM***; HN : HM NS
P	mean	1.79 ±0.17	1.16 ±0.27	1.52 ±0.08	C : HN***; C : HM***; HN : HM**
Mg	mean	1.09 ±0.10	1.13 ±0.12	1.13 ±0.08	NS
Chlorides	mean	104.25 ±5.44	89.63 ±7.71	97.63 ±3.54	C : HN***; C : HM*; HN : HM*

Ca – calcium; P – phosphorus; Mg – magnesium; ±standard deviation; * $P < 0.05$, ** $P < 0,01$, *** $P < 0.001$, NS – non significant; C – control group; HN – group 0.7% humic supplement Natur; HM – group 0.7% humic supplement Monogastric

Avci et al. (2007) achieved the opposite results in an experiment with quail fed with humic substances. The blood content of Ca was statistically significantly higher in the experimental groups ($P < 0.001$) compared to the control. The other biochemical parameters as phosphorus, glucose, triglycerides, cholesterol, LDLchol were not statistically significantly different ($P \geq 0.05$).

Jadúttová et al. (2019), in comparison to our findings, confirmed a reduction in the calcium and phosphorus content in the blood of broilers fed a diet with 0.8% addition of humic substances compared to the control. In the case of the addition of 1% humic substances into a feed mixture, the difference was no longer significant $P \geq 0.05$ compared to the control group.

From the parameters of the energy profile, the glucose content in the blood of broilers from the control group was significantly higher ($P < 0.001$) compared to the HN group (10.63 mmol/l) and at the level of significance $P < 0.05$ compared to the HM group (12.30 mmol/l) as well. The content of triglycerides in both experimental groups (0.83 mmol/l, 0.85 mmol/l, respectively) was higher statistically significantly compared to the control group ($P < 0.05$) (Table 4). Similarly as Bahodari et al. (2017), we analysed in our experiment lower cholesterol concentrations in groups of broilers with the addition of humic substances compared to the control group. In our experiment, the cholesterol content in the control group (2.81 mmol/l) was statistically significantly higher at the level of $P < 0.05$ compared to the HN and HM groups. Jaduttova et al. (2019) also found a reduction in blood cholesterol content in groups of broilers fed with the addition of humic substances at concentrations of 0.8% and 1%. The intestinal absorption of labelled cholesterol was monitored in a mouse model experiment. Statistically, significantly higher $P < 0.05$ cholesterol absorption was found in the group with the addition of humic substances (Tichá et al., 2009).

Table 4 Content of glucose, triglycerides and cholesterol in the blood of broilers (in mmol/l)

		C	HN	HM	
Glucose	mean	13.94 ± 0.77	10.63 ± 1.02	12.3 ± 1.96	C : HN***; C : HM*; HN : HM NS
Triglycerides	mean	0.59 ± 0.11	0.83 ± 0.24	0.85 ± 0.13	C : HN*; C : HM**; HN : HM NS
Cholesterol	mean	2.81 ± 0.2	1.74 ± 0.24	2.27 ± 0.32	C : HN***; C : HM**; HN : HM**

* $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$; NS – non significant, \pm standard deviation; C – control group; HN – group 0.7% humic supplement Natur; HM – group 0.7% humic supplement Monogastric

4 Conclusions

From the achieved results we can state that the applied two preparations of humic substances in the nutrition of broiler chickens did not have an impact on the monitored production parameter. A significant effect was found on the content of calcium, phosphorus, chlorides, glucose, triglycerides and cholesterol. The direction of further research will focus on the impact on the metabolism and quality of broiler products.

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References

- Arpašová, H. et al. (2016). Use of humic acid in nutrition of broiler chickens. *Slovenský chov*, 32–33. In Slovak.
- Avci, M. et al. (2007). Effects of humic acid at different levels on growth performance, carcass yields and some biochemical parameters of quails. *Journal of Animal and Veterinary Advances*, 6(1), 1–4.
- Bahodari, Z. et al. (2017). The effect of earthworm meal with vermi-humus on growth performance, haematology, immunity, intestinal microbiota, carcass characteristics, and meal quality of broiler chickens. *Livestock Science*, 202, 74–81. <https://doi.org/10.1016/j.livsci.2017.05.010>
- El-Zaiat, H. M. et al. (2018). Impact of humic acid as an organic additive on ruminal fermentation constituents, blood parameters and milk production in goats and their kids growth rate. *Journal of Animal and Feed Science*, 27(2), 105–113. <https://doi.org/10.22358/jafs/92074/2018>
- Hakan, K. et al. (2012). Effects of boric acid and humate supplementation on performance and egg quality parameters of laying hens. *Brazilian Journal of Poultry Science*, 14(4), 233–304. <https://doi.org/10.1590/S1516-635X2012000400008>

Jaduttová, I. et al. (2019). The effect of dietary humic substances on the fattening performance, carcass weight, blood biochemistry parameters and bone mineral profile of broiler chickens. *Acta Veterinaria Brno*, 88, 307–313. <https://doi.org/10.2754/avb201988030307>

Majewska, M. et al. (2017). Influence of humic acid supplemented to sheep diets on rumen enzymatic activity. *Medycyna Weterynaryjna*, 73(12), 770–773. <https://doi.org/10.21521/mw.5822>

Mudroňová, D. et al. (2020) The effect of humic substances on gut microbiota and immune response of broilers. *Food and Agricultural Immunology*, 31(1), 137–149. <https://doi.org/10.1080/09540105.2019.1707780>

Nagaraju, R. et al. (2014). Effect of dietary supplementation oh humic acids on performance of broilers. *Indian Journal of Animal Science*, 84(4), 447–452. <https://doi.org/PMC6811714>

Pistová, V. et al. (2017). The effect of the humic substances, garlic (*Allium sativum* L.), wormwood (*Artemisia absinthium*) and walnut (*Juglans regia*) on carcass parameters of broiler chickens. *Scientific Papers Animal Science and Biotechnologies*, 50(1), 234–237.

Rzasa, A. et al. (2014). Humic-fatty acid preparation in growing rabbits nutrition. *Journal of Polish Agricultural Universities*, 17(3), 1–6.

Terry, S. A. et al. (2018). Effect of humic substances on rumen fermentation, nutrient digestibility, methane emissions, and rumen microbiota in beef heifers. *Journal of Animal Science*, 96(9), 3863–3877. <https://doi.org/10.1093/jas/sky265>

Ticha, A. et al. (2009). Humic substances influence on cholesterol absorption. *Klinicka biochemie a metabolismus*, 17(1), 37–41. In Czech.

Vaško, L. et al. (2012). Humic acids in nutrition and effect on metabolism and health production. *Slovenský chov*, 5, 40–41. In Slovak.

Wang, Q. et al. (2008). Effects of supplemental humic substances on growth performance, blood characteristics and meat quality in finishing pigs. *Livestock Science*, 117(2–3), 270–274. <https://doi.org/10.1016/j.livsci.2007.12.024>

Yoruk, M. A. et al. (2004). The effects of supplementation of humate and probiotic on egg production and quality parameters during the late laying period in hens. *Poultry Science*, 83(1), 84–88. <https://doi.org/10.1093/ps/83.1.84>