The Effect of the Humic Substances, Garlic (*Allium sativum* L.), Wormwood (*Artemisia absinthium*) and Walnut (*Juglans regia*) on Growth Parameters and Mortality of Broiler Chickens

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Abstract

The aim of this experiment was to determine the influence of humic substances, garlic (*Allium sativum* L.), wormwood (*Artemisia absinthium*) and walnut (*Juglans regia*) on growth performance and mortality of broiler chickens. A total of 60 Ross 308 broiler chickens were divided into 3 groups (n=20). The control group of chickens was fed with complete feed mixtures without any additives. Chickens in the first experimental group E1 were fed a diet containing 1.5% of humic substances, 0.4% of garlic powder and 0.1% of wormwood. Chickens in the second experimental group E2 were fed a diet containing 1.5% of humic substances, 0.4% of garlic powder and 0.1% of walnut. The body weight, feed intake, feed conversion and total mortality were recorded in 42 day of fattening. At the end of the experiment was average body weight significantly higher ($P \leq 0.01$) in the first experimental group compared to the control group (values in the order of the groups: 1801.04±166.25; 1928.26±226.37 and 1850.24 g±SD). The feed intake was in the control group 3.59 kg per chicken, in the first experimental group E1 3.58 kg per chicken and in the second experimental group E2 3.45 kg per chicken. Feed conversion was in control group 1.95 kg, in the first experimental group E1 1.87 kg and in the second experimental group E2 1.84 kg with no significant different ($P \geq 0.05$) compared to the control group. Total mortality in 42 day was positive affected in the second experimental group, but with no significant different ($P \geq 0.05$) compared to the control group.

Key words: broiler chickens, garlic, growth, humic substances, mortality, walnut, wormwood.

1. Introduction

Humic substances are the most widely spread natural completing ligands occurring in nature. They have been shown to transfer micronutrients from soil to plants, enhance water retention, increase seed germination rates, and improve microbial populations in soils [1]. The biggest proportion from humic substances formed of humic acid. Humic acids are one of the potential substances alternatives to antibiotics in the diet of poultry [2]. [3] showed that the humic acids had positive effect on growth and meat quality. Interest in plants, plant extracts and derived phytochemicals as dietary additives for poultry has increased during the past decades [4]. Garlic (*Allium sativum* L.) is one of the most traditionally used plants as a spice herb. Garlic has been used for a variety of reasons: antiatherosclerosis, antimicrobial, hypolipidemic, antithrombosis, antihypertension, antidiabetes and etc. [5]. Wormwood (*Artemisia absinthium*) is used as stomachic, antiseptic, antispasmodic, carminative, cholagogue, febrifuge and anthelmintic. The

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extracts of the plant have shown to exhibit strong antimicrobial and antioxidative activity [6].

The objective of this study was to determine the effect of humic substances with garlic (*Allium sativum* L.), wormwood (*Artemisia absinthium*) and walnut (*Juglans regia*) on growth parameters and mortality of broiler chicken Ross 308.

2. Material and Methods

Animals and diets

The experiment was realized at the Department of Poultry Science and Small Farm Animals in the experimental poultry house on College farm in Kolíňany.

A total 240 unsexed one-day-old Ross 308 meat hybrid chicken were randomized into three groups, each containing 80 chickens in four replicates. Chickens in individual groups were stabled on deep litter with housing density 33 kg.m^2. During the fattening period, the light regimen based on 23 h of light and 1h of dark was used. The temperature at the beginning of the experiment was 31-33°C and weekly fell by 2°C to 20-22°C. Heating was maintained using electronic hen-like devices providing radiant heat.

The fattening lasted 42 days. The feeding program included three phases: starter (1-21 days of age), grower (22-35 days of age), and finisher (36-42 days of age). Feed and water were supplied *ad libitum.* Composition of complete feed mixtures is presented in Table 1.

In control group were used complete feed mixture without any additives. The first experimental group (E1) of chickens was fed a diet containing 1.5% of humic substances (humic acids 65%; fluvic acids 5%; Ca 42 278 mg/kg, Mg 5111 mg/kg, Fe 19 046 mg/kg, Cu 15 mg/kg, Zn 37 mg/kg, Mn 142 mg/kg, Co 1.24 mg/kg, Se 1.67 mg/kg, V 42.1 mg/kg, Mo 2.7 mg/kg; humidity 15% from Humic Acid Manufacturer Co., Košice, Slovakia), 0.4% of garlic powder and 0.1% of milled dried leaves of wormwood (Vetservis s.r.o., Nitra, Slovakia). The second experimental group (E2) of chickens was fed a diet containing 1.5% of humic substances (humic acids 65%; fluvic acids 5%; Ca 42 278 mg/kg, Mg 5111 mg/kg, Fe 19 046 mg/kg, Cu 15 mg/kg, Zn 37 mg/kg, Mn 142 mg/kg, Co 1.24 mg/kg, Se 1.67 mg/kg, V 42.1 mg/kg, Mo 2.7 mg/kg; humidity 15% from Humic Acid Manufacturer Co., Košice, Slovakia), 0.4% of garlic powder and 0.1% of milled dried leaves walnut (Vetservis s.r.o., Nitra, Slovakia).

Table 1. Composition of starter, grower and finisher diets

Ingredient	Unit	Feed mixture		
		Starter	Grower	Finisher
Wheat	%	35.00	35.00	36.82
Maize	%	35.00	40.00	37.00
Soybean meal	%	21.30	18.70	20.00
Fish meal 71 %	%	3.80	2.00	0.00
Dried blood	%	1.25	1.25	-
Limestone	%	1.00	1.05	1.10
Monocalcium phosphate	%	1.00	0.70	1.00
Salt	%	0.10	0.15	0.20
Sodium	%	0.15	0.20	0.25
Palm oil	%	0.70	0.16	2.50
Lysine	%	0.05	0.07	0.29
Methionine	%	0.15	0.22	0.29
Premix	%	0.50	0.50	0.50
Chemical composition				
Metabolic energy	MJ	12.01	12.03	12.37
Crude protein	g	210.76	190.42	170.58
Crude fiber	g	30.18	29.93	30.54
Crude ash	g	24.24	19.93	38.49
Lysine	g	11.30	9.89	9.95
Methionine	g	4.96	5.21	5.46
Ca	g	8.15	7.27	7.37
P	g	6.75	5.70	6.00

Performance parameters
Performance parameters as body weight, feed intake and feed conversion were recorded weekly, mortality was recorded daily.

Statistical analysis
Data were analyzed by analysis of variance using the general linear model procedure of the software program Statistical Analysis System. Differences between the indicators were tested using one-way analysis of variance by Duncan's test. Significance was considered at $P \leq 0.05$.

3. Results and discussion

The aim of the presented study was to investigate the effect of humic substances with garlic powder (*Allium sativum* L.), wormwood (*Artemisia absinthium*) and walnut (*Juglans regia*) to body weight, feed intake, feed conversion and motrality of Ross 308 broiler chickens. The influence of adding additives on body weight is presented in Table 2. Broiler chickens fed a diet containing 1.5% of humic substances, 0.4% of garlic powder and 0.1% of milled dried wormwood leaves (E1) showed statistically significant higher ($P \leq 0.01$) body weight at the end of experiment compared to the control group (C). The second experimental group of chicken (1.5% of humic substances, 0.4% of garlic powder and 0.1% of milled dried walnut leaves) showed higher body weight as control group, but not statistically significant ($P \geq 0.05$). These results agreed with results of [7; 8] who observed improvement of body weight of broiler chickens at addition of humic acids. The impact of use the garlic (*Allium sativum* L.) as additive to diet for broiler chickens in their work devoted [9]. Combination of garlic powder and *Trigonella foenum graecum* L. (5 and 10g/kg) caused an increase in body weight of broiler chickens. More significat effect observed in combination of garlic powder (5 and 10g/kg) with *Piper nigrum* (1 and 2g/kg). The use of wormwood (*Artemisia absinthium*) as plant additives for broiler chickens describes [10]. In their study were used 100, 150 and 200 g/kg of wormwood, with the best results in body weight of chickens by using 200 g/kg of wormwood.

Table 2. Effect of humic substances, garlic, wormwood and walnut on body weight of broiler chickens (g)

Day of fattening	Group		
	C	E1	E2
1	39.25	39.67	41.23
7	147.85 ± 21.83	144.31 ± 23.38	149.77 ± 21.26
14	314.27 ± 65.41	348.21 ± 66.33	355.04 ± 59.56
21	658.94 ± 106.19	640.52 ± 113.58	637.27± 102.2 7
28	964.22 ± 144.32	962.75 ± 146.12	958.26 ± 132.08
35	1386.33 ± 148.19	1368.73 ± 203.54	1396.96 ± 177.99
42	1801.54 ± 166.05	1928.86 ± 225.22 *	1810.84 ± 2119.78

C-control group; E1-complete feed mixture+ 1.5% humic substances+0.4% garlic+0.1% wormwood; E2-complete feed mixture+1.5% humic substances+0.4% garlic+0.1% walnut; n=60; Mean * with the superscript are significantly different at ($P \leq 0.01$); Mean ± Standard deviation

Feed intake, feed conversion and mortality are presented in Table 3. Feed intake and feed conversion of broiler chickens fed a diet containing 1.5% of humic substances, 0.4% of garlic powder and 0.1% of milled dried wormwood leaves (E1) and chickens fed a diet containing 1.5% of humic substances, 0.4% of garlic powder and 0.1% of milled dried walnut leaves (E2) were lower, but not statistically significant ($P \geq 0.05$) compared to control group (C). This is in accordance to results obtained by [2; 11], who introduced that the humic acid and garlic powder added into broiler feed had not significantly effect on feed intake and feed conversion. In contrast [12; 13] found, that the chickens had biggest feed intake by use of garlic powder in a broiler diet.

Table 3. Effect of humic substances, garlic, wormwood and walnut on feed intake, feed conversion and mortality of broiler chickens

	Unit	C	T1	T2
Average feed intake per 1 chicken	kg	3,59	3,58	3,45
Average feed conversion	kg	2,08	1,95	1,87
Mortality	%	4	2	0

C-control group; E1-complete feed mixture+1.5% humic substances+0.4% garlic+0.1% wormwood; E2-complete feed mixture+1.5% humic substances+0.4% garlic+0.1% walnut; n=60; Mean * with the superscript are significantly different at (P≤0.01); Mean ± Standard deviation

The total mortality was not recorded in the second experimental group of chickens that consumed a diet containing 1.5% of humic substances, 0.4% of garlic powder and milled dried walnut leaves (E2). In the first experimental group (E1) of chickens that consumed a diet with 1.5% of humic substances, 0.4% of garlic powder and 0.1% of milled dried wormwood leaves was recorded low mortality (2%) compared with the control group (4%). These results agree with the work of [14; 15], who obtained improvement of mortality of broiler chickens by use humic acid and garlic powder.

4. Conclusion

Based on the obtained results, it can be concluded that the humic substances with garlic (*Allium sativum* L.), wormwood (*Artemisia absinthium*) and walnut (*Juglans regia*) has positive effect on growth, feed intake, feed conversion and mortality of broiler chicken. Broiler chickens Ross 308 fed a diet containing 1.5% of humic substances, 0.4% of garlic powder and milled dried wormwood leaves (E1) showed significantly higher (P≤0.01) body weight compared to the control group (C). Feed intake, feed conversion and mortality of broiler chickens Ross 308 in the both experimental groups were improved with supplementation of additives, particularly E2 group reached the lowest values in feed intake (3.45kg), feed conversion (1.87kg) and mortality (0%), but these values were not statistically significant (P≥0.05) compared to control group (C).

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