J. Elementol. 2009, 14(3): 489–500

SILICA GRIT, CHARCOAL AND HARDWOOD ASH IN TURKEY NUTRITION

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Abstract

The objective of this study was to determine whether silica grit is a necessary dietary additive for turkeys raised in intensive production farms, and whether it can be replaced by other supplements such as charcoal or hardwood ash. The conclusions were formulated based on performance results, blood hematological and biochemical indices, the slaughter quality of turkeys, as well as on the chemical and physicochemical properties of turkey meat. The experimental material comprised 360 male Big 6 heavy-type turkeys randomly divided into 4 treatments and raised on litter until 20 weeks of age. Birds of all treatments were fed identical complete pelleted basal diets. The experimental factor were various feed supplements in each group. The control treatment was fed a diet without supplements. The diets for experimental groups were supplemented with silica grit (SG), charcoal (CH) or hardwood ash (HA) in the amount of 0.3% of the administered feed mix. Dietary supplements were administered from the first day of life until the end of the rearing period. No significant changes in blood hematological and biochemical indices of turkeys were observed. Silica grit (SG) had an adverse effect on the performance results of turkeys, while the addition of both CH and HA had a highly beneficial impact. The best results were reported in respect of charcoal. The treatment fed a diet supplemented with CH was characterized by the lowest mortality rate of 4.4%, i.e. half that observed in the control group, body weight higher by 3.9% and rearing efficiency index higher by 9.7%.

Key words: silica grit, charcoal, hardwood ash, performance, slaughter quality, turkeys.

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ŻWIREK KRZEMOWY, WĘGIEL DRZEWNY I POPIÓŁ Z DRZEW LIŚCIASTYCH W ŻYWIENIU INDYKÓW

Abstrakt

Celem badań było określenie, czy w żywieniu indyków utrzymywanych w warunkach intensywnej produkcji potrzebny jest żwirek krzemowy i czy można go zastąpić takimi dodatkami, jak węgiel drzewny i popiół z drzew liściastych. Wnioskowano na podstawie wyników odchowu, wskaźników hematologicznych i biochemicznych krwi oraz wartości rzeźnej, składu chemicznego i właściwości fizykochemicznych mięsa indyków. Materiał doświadczalny stanowiło 360 indorów typu ciężkiego Big 6, które rozdzielono losowo do 4 grup i odchowywano do 20. tygodnia życia na ściółce. Ptaki ze wszystkich grup żywiono jednakowymi granulowanymi pełnoporcjowymi mieszankami. Żywienie ptaków z poszczególnych grup różniło się tylko zastosowanymi dodatkami paszowymi. Grupa kontrolna nie otrzymywała żadnego dodatku. W grupach doświadczalnych zastosowano do paszy dodatek: żwirku krzemowego, węgla drzewnego lub popiołu z drzew liściastych w ilości 0,3% zadawanej mieszanki. Dodatki stosowano od 1. dnia życia do końca okresu odchowu. Nie odnotowano istotnych różnic we wskaźnikach hematologicznych i biochemicznych krwi indyków. Stwierdzono, że zastosowanie żwirku krzemowego pogorszyło wyniki odchowu indorów, natomiast dodatek zarówno węgla drzewnego, jak i popiołu z drzew liściastych wpłynął bardzo korzystnie na efekty produkcyjne odchowu tych ptaków. Najlepsze efekty otrzymano stosując dodatek węgla drzewnego. U indorów z tej grupy stwierdzono najmniejszą śmiertelność – 4,4%, o 3,9% większą masą ciała i o 9,7% lepszy wskaźnik efektywności odchowu, w porównaniu z grupą kontrolną.

Słowa kluczowe: żwirek krzemowy, węgiel drzewny, popiół z drzew liściastych, indyki.

INTRODUCTION

When raised in a natural environment, birds show a strong appetite for silica grit. In intensive poultry production farms, the use of silica grit was abandoned due to technical difficulties. Slaughter houses continue to oppose the use of silica grit in poultry feed due to possible overestimation of the weight of birds intended for slaughter and the complex procedure of gizzard cleaning. It was believed that silica grit had no nutritional value and that it did not affect the digestive process as silicon cannot be digested by birds. Yet feed mixing in the acidic environment of the gizzard releases silicon ions which form weak inorganic acids – metasilicic acid (H_2SiO_3) and orthosilicic acid (H_4SiO_4) of white coloring. Since they occur in sol or gel form, they have a very large absorptive surface and are strong adsorbents for gas, toxins and bacteria. Those acids have bactericidal and healing properties, they control metabolism, boost immunity and play a vital role in medical treatment. Poultry feed supplementation with silicon is not required under the applicable norms, but silicon ions determine the availability of other micronutrients (NICHOLAS et al. 2001). Silicon deficiency in animals inhibits growth, leads to atrophy of organs, disrupts the formation of bones and connective tissue, causes inflammations of the mucosa and of the skin

(Bodak et al. 1997). In birds, it causes flaccidity of the proventriculus, lack of appetite, anemia, diarrhea, paresis of the legs and wings (Elliot, Edwards 1991, Roland et al. 1993). In addition to feed grinding, the presence of silica grit in chicken gizzards also had a sterilizing, emulsifying and thermoregulating effect.

Published sources indicate that in intensive poultry production, silica grit may be replaced by pulverized charcoal, hardwood ash or straw. Those additives are easier to administer because they are not subject to sedimentation and they do not overload the gizzard. They are sterile and are a source of various elements occurring in natural proportions with an adequate nutritive value. Pulverized charcoal and silicic acid gel are believed to be the strongest natural adsorbents for gas, bacterial toxins and mycotoxins (Edrington et al. 1997, Kutlu at al. 1999, Wang et al. 2006). They physically absorb gas and toxins. The absorptive surface of 1 g of charcoal can reach 1 ha.

The objective of this study was to determine whether silica grit is a necessary dietary additive for turkeys raised in intensive production farms, and whether it can be replaced by other supplements such as charcoal or hardwood ash. The conclusions were formulated based on performance results, blood hematological and biochemical indices, the slaughter value of turkeys, as well as on the chemical and physicochemical properties of turkey meat.

MATERIAL AND METHODS

The experiment was conducted at the State Turkey Evaluation Station of the University of Warmia and Mazury (Olsztyn, Poland), according to the guidelines of the local animal experimentation ethics committee. The experimental material comprised 360 male Big 6 heavy-type turkeys, sexed at the local commercial hatchery (Grelavi Co., Kętrzyn, Poland). One-day-old poults were randomly divided into 4 groups. The experiment was performed in three replications, each of 30 birds. Turkeys were raised on litter until 20 weeks of age in a building with a controlled environment. Birds of all groups were fed identical complete pelleted wheat-soybean diets in a five-stage system, supplied by the local commercial animal feed mill Agrocentrum Co., Kolno, Poland. The nutritional value of feed was consistent with BUT (British United Turkeys Ltd.) recommendations (Table 1). The experimental factor were various feed supplements in each group. The control treatment (Control) was fed a diet without supplements. The diets for experimental groups were supplemented with silica grit (SG) in the amount of 0.3% of the administered feed mix, charcoal (CH) at 0.3% and hardwood ash (HA) at 0.3%. Dietary supplements were administered from the first day of life until the end of the rearing period. Feed and fresh water were offered ad libitum.

Table 1

Composition (g kg^{-1}) and calculated nutrient content of the basal diets fed to turkeys from 1 to 20 weeks of age

Specification	Starter 1	Starter 2	Grower 1	Grower 2	Finisher
	1 – 4 weeks	5 – 8 weeks	9 – 12 weeks	13 – 16 weeks	17 – 20 weeks
Components					
Wheat	194.3	264.3	488.4	665.9	485.3
Maize	250.0	250.0	100.0	100.0	100.0
Triticale	-	-	-	-	150.0
Potato protein	50.0		-	-	-
Soybean meal, 46% CP	425.0	388.0	327.3	200.0	172.1
Soybean oil, 98%	22.0	21.0	43.2	-	20.0
Animal fat, 99%	-	-	-	-	40.9
Limestone	12.4	12.0	11.6	11.3	9.2
Monocalcium phosphate	32.4	27.0	14.8	12.2	11.7
Na_3PO_4	1.3	1.3	1.3	1.3	0.7
DL methionine 99	3.0	2.6	2.6	0.8	1.0
L lysine 99 HCL	3.6	3.2	4.1	3.0	3.2
L threonine	1.0	0.6	1.7	0.5	0.9
Vitamin-mineral premix*	5.0	5.0	5.0	5.0	5.0
Nutrients (calculated)					
ME, kcal kg^{-1}	2789	2822	3000	3146	3250
Crude protein, %	28.05	25.16	21.78	17.17	16.25
Lysine, %	1.82	1.58	1.39	1.00	0.96
Methionine + Cystine, %	1.18	1.05	0.94	0.65	0.64
Threonine, %	1.16	0.99	0.94	0.64	0.64
Tryptophan, %	0.32	0.29	0.25	0.19	0.18
Ca, %	1.34	1.20	0.90	0.80	0.70
Available P, %	0.74	0.65	0.45	0.40	0.37
Na, %	0.05	0.05	0.05	0.04	0.03
Cl, %	0.17	0.17	0.16	0.16	0.11

* supplied the following per kilogram of starter/grower-finisher diet: vitamin A (all-trans retinol acetate), 15,000/13,000 IU; cholecalciferol, 4,000/3,000 IU; vitamin E (all-rac-α-tocopherol acetate), 40/35 mg; vitamin K (menadione Na bisulfate), 2.5/2 mg; thiamin (thiamin mononitrate), 2.5/2 mg; riboflavin, 10/8 mg; niacin, 70/65 mg; vitamin B_6, 5/3.5 mg; pantothenic acid, 20/18 mg; folic acid, 2/1.5 mg; biotin, 0.3/0.2 mg; choline (choline chloride), 600/400 mg; Mn, 120/100 mg; Zn ($ZnSO_4 \cdot 7H_2O$), 90/80 mg; Fe ($FeSO_4 \cdot 7H_2O$), 60/50 mg; Cu ($CuSO_4 \cdot 5H_2O$), 10/8 mg; J, 1/0.8 mg; Se (Na_2SeO_3), 0.3/0.3 mg.

All husbandry practices and euthanasia were carried out with full consideration of animal welfare. Poults were vaccinated with Nobilis TRT on the first day of life. Stocking density was approximately 50 kg LBW m^{-2} of usable floor space in all pens. Brooder rings for poults (till 10 days of age) and additional heat sources (till 28 days of age) were installed in the pens. Heating was provided by a central heating system and electric heaters (red light). The brooder unit's temperature was set at 35°C and then altered as needed to suit bird comfort. Room temperature was set at 28°C on the day of placement, and was subsequently reduced by 2°C per week. The temperature and humidity were recorded on a daily basis at 8 AM and 3 PM. The lighting program in the room was as follows: 23 h light at about 100 lux till 3 days of age and 14 h light at 5-6 lx from day 4 until the end of the experiment. Relative humidity was approximately 65 to 70%. Air changes were 0.4--0.5 m^3 h^{-1} kg^{-1} of BW from 2 to 7 weeks of age and 7-8 m^3 h^{-1} kg^{-1} of BW from 8 weeks of age.

Visual health inspection of all birds was performed on a daily basis. Mortality rates, culling rates and the body weight of dead birds were also recorded every day. Feed intake per pen and the body weight of turkeys per pen were recorded on day 21, 70 and 140. The results provided a basis for calculating the Rearing Efficiency Index (REI), according to the formula:

$$\text{REI} = \frac{\text{average live body weight (kg)} \cdot \text{liveability (\%)} \cdot 100}{\text{feed conversion ratio (kg feed kg}^{-1}\text{ body weight)} \cdot \text{number of rearing days}}$$

Additionally, carcass characteristics (dressing percentage and breast, thigh and drumstick muscles) were determined after 20 weeks of the experiment.

At the end of the rearing period, 6 turkey-toms with the most average body weight were selected from each group and were sacrificed after 12 hours of fasting, according to the recommendations for euthanasia of experimental animals (CLOSE et al. 1997). During slaughter, blood samples were collected from every bird for hematological and biochemical analyses. The hemoglobin content (HGB), hematocrit levels (HCT), red blood cell (RBC) and white blood cell (WBC) counts were determined by routine methods (KOKOT 1989). The following biochemical parameters were determined: total protein content in the blood serum by the Biuret method, triglycerides content by the enzymatic method, activity of alkaline phosphatase (ALP), aspartate aminotransferase (AST) and creatine kinase (CK) with the use of the method proposed by Reitman and Fränkel (as cited in KRAWCZYŃSKI, OSIŃSKI 1967).

Charcoal, hardwood ash and silica grit samples were spectrally etched with pure acid (Merck) in a Milestone microwave labstation (manufactured in Italy) under the pressure of 100 atm until completely mineralized. Three analytical tests were performed for each investigated micronutrient. Quantitative analyses of total carbon content in SG, CH and HA were performed with the use of an Eurovector elemental analyzer (manufactured in Italy). Si, Ca, P, Mg and Zn levels were determined with the use of a plasma spectrometer interfaced with the Philips Scientific PU 7000 analytical system. The analytical device was applied to determine the content of the analyzed elements in Ar ICP (Inductively Coupled Plasma) flame.

Plucked, eviscerated and chilled (4°C, 12 h) carcasses were dissected to determine the dressing percentage of each primal. The proximate chemical composition, physical and chemical properties of breast muscle samples were determined. The dry matter, total protein, crude fat and ash content of meat were measured by traditional methods (AOAC, 1990). 5 g of raw meat was homogenized with 5 ml of distilled water and the ultimate pH (pHu) of meat was measured with a WTW inoLab level 2 pH-meter equipped with a Hamilton Polylite Lab electrode. The free water content of meat samples, prepared according to Honikel (1998), was determined by the Grau and Hamm method (Oeckel van 1999). Meat color brightness was measured as described by Różyczka et al. (1968) with the use of a SPEKOL spectrocolorimeter with an R-0-45 remission attachment at a wavelength of 560 nm.

The results were verified statistically by one-factorial analysis of variance (ANOVA). The significance of differences between groups was estimated by Duncan's test. A pen was considered as a replicate experimental unit. Treatment effects were considered to be significant at $P = 0.05$.

RESULTS AND DISCUSSION

During chemical analyses of feed additives (Table 2), three analytical measurements were performed for each investigated element. The highest Ca, P, Mg and Zn content was determined in hardwood ash where average levels of those micronutrients were also marked by high standard deviation.

All poults used in the experiment were in good condition as no deaths were observed in the first three weeks of rearing (Table 3). The first deaths in all groups, except for the group fed a diet supplemented with charcoal, were reported in the sixth week of rearing. Wattle formation begins around this period and it usually weakens the birds' immune system. The highest mortality rate of 6.7% observed at that time without a clearly identifiable cause occurred in the group of birds fed a diet supplemented with silica grit. Although no invasive diseases were reported in subsequent weeks of rearing, the highest mortality rate (11.1%) in the entire 20-week rearing period was also reported in the group of turkeys receiving silica grit. A possible cause could be the quality of the administered grit which was obtained directly from a gravel mine without prior rinsing. Gravel types other than

Table 2

Concentrations of selected nutrients in feed additives

Nutrient	Silica grit	Charcoal	Hardwood ash
C, %	0.08 ± 0.00	82.97 ± 4.26	13.23 ± 3.67
Si, %	38.01 ± 0.60	0.22 ± 0.03	4.12 ± 1.46
Ca, %	26.70 ± 0.09	1.27 ± 1.10	27.43 ± 4.42
Mg, %	0.42 ± 0.85	0.13 ± 0.11	1.45 ± 0.35
P, %	0.13 ± 0.01	0.49 ± 0.23	1.22 ± 0.23
Zn, mg kg^{-1}	15.57 ± 0.21	337.0 ± 44.90	1121.6 ± 305.6

Table 3

Effect of diets containing silica grit, charcoal or hardwood ash on the body weight and feed conversion ratio (FCR) of turkeys raised from 1 to 140 days of age

Specification	Control	Silica grit	Charcoal	Hardwood ash
Mortality (%)				
0-20 wk	8.8	11.1	4.4	6.6
Culling (%)				
0-20 wk	2.2	4.4	-	-
Body weight (kg)				
1 wk	0.16 ± 0.01	0.16 ± 0.01	0.16 ± 0.02	0.15 ± 0.02
3 wk	0.49 ± 0.04^{b}	0.52 ± 0.05^{ab}	0.54 ± 0.06^{a}	0.50 ± 0.03^{ab}
10 wk	4.91 ± 0.48^{b}	4.96 ± 0.59^{b}	5.09 ± 0.77^{a}	4.95 ± 0.59^{b}
20 wk	16.12 ± 1.26^{b}	16.23 ± 1.51^{b}	16.73 ± 1.14^{a}	16.73 ± 1.03^{a}
%	100.0	100.7	103.8	103.7
Feed conversion ratio, kg kg^{-1} body weight gain				
0 - 20 wk	2.81 ± 0.09	2.78 ± 0.10	2.79 ± 0.04	2.76 ± 0.06
%	100.0	98.9	99.3	98.2
Rearing Efficiency Index, points				
0 - 20 wk	373	371	409	404

Means within the same line with no common superscripts differ: $^{a\text{-}b}=P \leq 0.05$.

river gravel contain compounds which are toxic for birds and can easily upset systemic homeostasis. Clinical symptoms of disease are not always manifested. Impaired immunity can lead to death for no apparent reason. The mortality rate in the control group reached 8.8% and in the group fed a diet supplemented with hardwood ash – 6.6%. The lowest mortality rate was reported among turkeys receiving charcoal (4.4%), i.e. half that observed in the control group. Culling was not necessary in the group of birds fed a diet with the addition of charcoal (Table 3).

The applied feed supplements had a statistically significant effect ($P < 0.05$) on the final body weights of turkeys. After 3 weeks of rearing, the body weight of birds fed a diet supplemented with charcoal was significantly higher ($P < 0.05$) than that of control group turkeys. After 10 weeks of rearing, their body weight was significantly higher ($P < 0.05$) in comparison with the remaining groups. After 20 weeks of rearing, the highest body weight was reported in groups receiving pulverized charcoal and hardwood ash, i.e. in groups marked by the lowest mortality rates. The final body weight of those birds was identical (16.73 kg) and significantly higher (more than 3%; $P < 0.05$) than that of control group turkeys and of birds fed diets with the addition of silica grit. Charcoal seems to have a particularly beneficial effect in the initial rearing period as 3-week-old turkeys of this group were 12% heavier ($P < 0.05$) than control birds. Average body weight results also indicate that silica grit may be added to feed only in the initial periods of life because as of the third week of rearing, the body weight of turkeys receiving grit was 7% higher in comparison with the control group. After this period, a higher mortality rate with a simultaneous drop in body weight were noted in birds fed diets supplemented with silica grit.

The supplements applied in this experiment improved the feed conversion ratio (by around 1.0-1.8%, Table 3), but the resulting differences were not statistically verified. The rearing efficiency index (REI) of turkeys fed charcoal and hardwood ash additives reached 409 and 404 points, respectively (Table 3), and it was approximately 9% higher than in the control group. The lowest feed efficiency was observed in control group birds which consumed 2.81 kg of feed per kg of body weight gain.

In a previous study (MAJEWSKA et al. 2002), after 18 weeks of rearing, the body weight of turkeys fed diets supplemented with 0.3% charcoal throughout the entire rearing period increased by 5.9% ($P < 0.01$), while FCR dropped by 6.5% in comparison with the control group. The mortality rate of turkeys receiving charcoal was only 1.0%, while it reached a high level of 12.7% in the control group. In another study (MAJEWSKA, ZABOROWSKI 2003), broiler chickens fed diets supplemented with 0.3% charcoal were 4% heavier after 6 weeks of rearing in comparison with control birds. The benefits of charcoal in the nutrition of broiler chickens were also recognized by other authors. EDRINGTON et al. (1997) fed broiler chickens a diet supplemented with 0.5% superactivated charcoal (SAC) and observed a 4.4% increase in body weight in comparison with the control group already after 21 days. The authors attributed this effect to the presence of available microelements and the detoxicating effect of charcoal. In the first 3 weeks of chicken rearing, KUTLU and UNSAL (1998) noted that dietary wood charcoal affected ($P < 0.01$) feed intake, body weight gain and feed conversion ratio. In a study carried out by KUTLU et al. (1999) who applied feed supplemented with 2.5% charcoal only in the first three weeks of rearing, the body weight of 6-week-old chicks increased by 165 g, i.e. 7.8%, and this increase was statistically higher ($P < 0.05$) than in the group of birds whose diet was not supplemented with charcoal. According to other authors (EDRINGTON et al. 1997, KUTLU et al. 1999, MAJEWSKA, SIWIK 2006), the addition of charcoal and superactivated charcoal did not affect the feed conversion ratio in broiler chickens.

The authors observed no significant changes in blood hematological and biochemical indices (Tables 4 and 5) which would be indicative of the effect of feed additives or a deterioration in the turkeys' health condition. In both the control treatment (not receiving additives) and the group of birds fed diets supplemented with SG, CH and HA, the above indicators were within physiological limits (KRASNODĘBSKA-DEPTA, KONCICKI 1999, 2000). Only a minor (statistically non-significant) increase in blood zinc levels was noted in birds receiving charcoal and hardwood ash. No changes in blood hematological and biochemical indices of chickens and turkeys were observed by ERINGTON et al. (1997) who supplemented feed with superactivated carbon or MAJEWSKA et al. (2002) who used charcoal feed additives.

Table 4

Effect of diets containing silica grit, charcoal or hardwood ash on blood hematological indices in 20-week-old turkeys

Specification	Control	Silica grit	Charcoal	Hardwood ash
RBC, 10^{12} l^{-1}	2.28 ± 0.20	2.32 ± 0.33	2.35 ± 0.22	2.38 ± 0.16
WBC, 10^{9} l^{-1}	15.50 ± 0.81	14.81 ± 1.26	17.05 ± 0.56	15.42 ± 1.42
HGB, g dl^{-1}	10.40 ± 0.78	11.36 ± 0.57	11.63 ± 0.97	11.15 ± 0.81
HCT, %	33.0 ± 1.72	32.32 ± 1.49	33.51 ± 3.38	33.63 ± 0.94

RBC – red blood cell, WBC – white blood cell, HGB – hemoglobin, HCT – hematocrit

In this experiment, the applied feed additives had no statistically significant effect on the carcass yield of 20-week-old turkeys (Table 6). The only significant difference ($P = 0.05$) was noted in respect of liver weight in turkeys receiving CH in comparison with turkeys fed a diet supplemented with SG whose livers were the lightest. This effect could be attributed to the fact that SG present in the proventriculus is capable of absorbing heat from the liver, thus simulating this organ. Yet the obtained results did not support this hypothesis. In a research conducted by MAJEWSKA and SIWIK (2006), the addition of SG, CH and HA did not affect the slaughter value of broiler chickens. Other authors (KUTLU, UNSAL 1998, KUTLU et al. 1999) noted that charcoal inclusion to the diets for chickens tended to reduce abdominal fat weight and abdominal fat percentages, while having no significant effects on carcass yield.

Diets supplemented with feed additives did not affect the chemical composition and physicochemical properties of meat (Table 7). The results of research carried out by KUTLU and UNSAL (1998) also showed that charcoal inclusion did not affect carcass dry matter, fat and protein content.

Table 5

Effect of diets containing silica grit, charcoal or hardwood ash on blood biochemical indices in 20-week-old turkeys

Specification	Control	Silica grit	Charcoal	Hardwood ash
Total protein, g dl^{-1}	5.25 ± 0.38	5.28 ± 0.59	5.24 ± 0.19	5.30 ± 0.19
Triglycerides, mg dl^{-1}	26.17 ± 2.08	26.59 ± 1.02	32.27 ± 5.20	30.19 ± 9.14
Total cholesterol, mg dl^{-1}	148.0 ± 30.8	152.3 ± 18.9	156.0 ± 13.1	160.7 ± 22.9
Ca, mg dl^{-1}	12.17 ± 0.71	11.57 ± 1.12	12.49 ± 1.65	12.21 ± 0.76
P, mg dl^{-1}	3.23±0.90	3.61±0.47	3.65±0.80	3.44±0.48
Zn, mg dl^{-1}	208.6 ± 24.0	214.6 ± 61.6	268.5 ± 68.0	273.5 ± 88.9
Mg, mg dl^{-1}	2.96 ± 0.11	3.14 ± 0.42	3.11 ± 0.54	3.72 ± 0.22
Uric acid, mg dl^{-1}	221 ± 80	322 ± 50	246 ± 99	191 ± 70
ALP, U l^{-1}	537 ± 96	547 ± 131	606 ± 122	558 ± 85
CK, U l^{-1}	4677 ± 747	5411 ± 950	5708 ± 561	4937 ± 192
AST, U l^{-1}	106 ±18	119 ± 38	136 ± 27	100 ± 12

ALP – alkaline phosphatase, CK – creatine kinase, AST – aspartate aminotransferase

All of the above cited authors noted that charcoal supplementation had a beneficial effect on bird health, production efficiency and product quality. Charcoal is a cheap and environment-friendly feed additive. The positive influence of charcoal results from the presence of mineral compounds and from the uptake and adsorption of gases. The ions produced when charcoal mixes with feed in the gizzard can activate enzymes, hormones, vitamins and antibodies. The minerals contained in charcoal mix with water to form lye, which can decrease the surface tension of intestinal digesta. Due to its extensive absorptive area, charcoal permits physical adsorption of gases and toxins produced during the digestive process, as well as toxic substances secreted by bacteria and fungi. Since activated charcoal contributes to enhancing the immune responses, the supplied nutrients may be effectively used to increase body weight and not to produce antibodies or develop defense mechanisms. There are no published data documenting the use of hardwood ash in poultry nutrition, but the results of this study indicate that this supplement could also enhance production efficiency. Charcoal and hardwood ash are environment-friendly and inexpensive additives, which contain mineral nutrients, do not undergo sedimentation (separation) in feed and, similarly to silica gel, have a very large absorptive area.

CONCLUSION

In conclusion, this experiment has shown that modern turkey rearing methods do not require the inclusion of silica grit in animal diets. Nevertheless, diet supplementation with charcoal or hardwood ash in the amount of 0.3% of the administered feed mix could have a beneficial effect on performance of turkeys. Turkeys fed a diet supplemented with 0.3% charcoal were characterized by the lowest mortality rate of 4.4%, i.e. half that noted in the control treatment, body weight higher by 3.9% and rearing efficiency index higher by 9.7%.

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