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A note on the effect of charcoal supplementation on the performance of Big 6 heavy tom turkeys

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ABSTRACT

The experiment was conducted on 204 Big 6 heavy tom turkeys. One-day-old chickens were allocated to two feeding groups, each with three replicates of 34 birds. All of the birds were fed identical granulated standard feeds in a three-stage system. The control birds were fed unsupplemented feed, the birds in the treatment group received a feed supplemented with pulverized hardwood charcoal at a dose of 3 kg/ton. Charcoal was given from day one of life for the entire period of rearing.

The use of charcoal had a beneficial effect on performance. After 18 weeks of rearing, turkeys given charcoal-supplemented feed were 5.9% heavier (on average 870 g) and had a 6.5% better feed conversion ratio than the control birds. Survival in the group receiving charcoal was 99% as compared with 87.3% in the control group. The crude protein content of the breast muscles of the experimental group increased significantly. The European Production Index equaled 393 for the control group and 504 for the charcoal-supplemented group.

KEY WORDS: charcoal-supplemented, turkeys, performance

INTRODUCTION

Charcoal obtained through dry distillation of hardwood contains about 96% pure charcoal and 4% of other mineral compounds. The mineral compounds in charcoal are in organic form. When they are dissolved in water they act as biocatalysts that can contribute to regulating metabolic processes, maintaining the proper osmotic potential of body fluids, activating enzymes, hormones and antibodies.

Charcoal has enormous absorptive properties. It acts curatively on the gastrointestinal tract, absorbing gases such as hydrogen sulphide and ammonia that

are formed there, bacterial toxins as well as mycotoxins produced by fungi (Anjaneyulu and Rao, 1993; Edrington et al., 1997; Shareef et al., 1998). According to Garwacki and Wiechetek (1998) the use of charcoal is also beneficial in cases of poisoning by such compounds as alkaloids, phenols, glycosides, and even strychnine and potassium cyanide. Charcoal is not digested in the GI tract and binds various substances through physical interactions regardless of whether they are ionized or not. By binding ammonia, charcoal protects the intestines from alkalization. It prevents intestinal infections and stops the diarrhoea caused by them by adsorbing and eliminating the germs with the faeces, but it is not bactericidal. The minerals contained in charcoal form bases with water, lower the surface tension of the digesta, emulsify fat, thereby support liver function and enable the digestion and assimilation of fat. The beneficial effect of charcoal on humans and animals has been known for a long time. Its favourable influence on increasing the body weight of broiler chickens, their survival and feed utilization was described by Anjaneyulu and Rao (1993), Edrington et al. (1997) Shareef et al. (1998) and Majewska et al. (1999)

The purpose of this study was to examine the effect of hardwood charcoal on the performance of Big 6 heavy tom turkeys.

MATERIAL AND METHODS

The experiment was conducted on the poultry farm of the University of Warmia and Mazury in Olsztyn. The experimental material comprised 204 one-day old heavy Big 6 tom turkeys purchased from the Canadian company Cuddy. The chickens were allocated to two feeding groups, each with three replicates of 34 birds and were maintained for 18 weeks on litter. The birds in both groups were fed identical granulated standard feeds in a 3-stage system, IB-1, IB-2, IB-3. Feed composition and nutrient value are presented in Table 1. The birds in group I (control) did not receive charcoal, those in group II received pulverized hardwood charcoal from the first day of life during the entire period of rearing as a feed supplement in an amount of 3 kg per ton of feed.

All of the birds were weighed individually at the end of weeks 5, 7, 11, 15 and 18 of life. Feed consumption was determined per group per week, culling and mortality were recorded daily. After the end of the experiment 9 birds from each group with body weights close to those of the group average were slaughtered and dissected. Breast meat was immediately minced, homogenized and samples were subjected to chemical and physicochemical analysis. The dry matter, crude protein, crude fat and crude ash contents were determined by conventional methods. Water holding capacity was determined by the Grau and Hamm method (1953), colour on the basis of the spectrometric method of Kortz et al. (1968),

TABLE 1

Composition and nutritive value of feed mixtures, g/kg

Specification	Feed mixtures		
	IB-1	IB-2	IB-3
	Period of feeding (weeks of life)		
	0 – 7	8 - 11	12 - 18
Wheat	310.0	370.0	624.0
Maize	100.0	100.0	100.0
Soyabean oilmeal (46% CP)	411.4	353.6	150.0
Meat and bone meal (58% CP)	100.0	70.0	40.0
Soya oil	40.0	60.0	50.0
NaCl	0.6	0.6	1.0
Dicalcium phosphate	21.0	23.0	19.0
Limestone	2.0	7.0	2.5
DL-Met	2.5	2.8	1.5
Lys	2.5	3.0	2.0
Mineral-vitamin premix	10.0	10.0	10.0
Crude protein	280.0	240.0	160.0
ME, MJ/kg	11.86	12.72	13.35
Crude fibre	28.0	33.0	35.0
Met	7.1	5.9	3.7
Lys	17.0	14.0	10.0
Ca	13.5	11.7	9.9
Available P	7.0	5.5	4.4

acidity on the basis of pH of aqueous homogenates using a Radiometr pH-meter with a combined electrode. Blood for routine haematological and biochemical tests was sampled from the slaughtered birds. The red blood cell (RBC) and white blood cell (WBC) counts were determined by the chamber method, the haemoglobin content (Hb) was assayed colorimetrically, haematocrit value (Ht) by the microhaematocrit method. Glucose, protein and cholesterol levels were determined using Alpha Diagnosticks and Pointe Scientific kits and an Epoll 20 photometer.

The European Production Index (EPI) was calculated using the formula:

$$EPI = \frac{\text{body weight (kg) x survival (\%)}}{\text{days of rearing x feed conversion ratio (kg/kg)}} \text{ x } 100$$

The results were subjected to statistical analysis using variance analysis in orthogonal and nonorthogonal models using Stat 1 software (Mikołajczak, 1993).

RESULTS AND DISCUSSION

A beneficial effect of added charcoal on body weight was noted starting from the fifth week of rearing (Table 2). At the end of the experiment after 18 weeks, the birds in the group receiving 0.3% charcoal were significantly, 870 g, i.e. 5.9% ($P<0.01$), heavier than those in the control group. The addition of charcoal favourably affected the feed conversion ratio (Table 2). Tom turkeys receiving

TABLE 2

Body weight (kg) of turkeys, feed conversion ratio (FCR) kg/kg, mortality and culling, %

Specification	Groups		SEM
	I	II	
Body weight at weeks:			
5	1.47^{B}	1.57^{A}	0.142
7	3.28^{B}	3.40^{A}	0.280
11	6.78^{B}	7.20^{A}	0.566
16	13.01^{B}	13.57^{A}	0.863
18	14.74^{B}	15.61^{A}	1.052
% of total	100	105.9	
Feed conversion ratio kg/kg weeks:			
0 – 5	**1.66**	1.63	0.045
0 – 7	**1.64**	1.66	0.044
0 – 11	**1.91**	1.79	0.055
0 – 16	2.29	2.10	0.122
0 – 18	2.62	2.45	0.120
% of total	100	93.5	
Mortality, % weeks:			
0 – 1	**7.8**	0.98	
2 – 18	4.9	-	
0 – 18	12.7	0.98	
Culling weeks:			
0 – 1	-	-	
2 – 18	**4.9**	3.9	
0 – 18	4.9	3.9	

^{A,B} – mean values in the rows with different letters were significantly different at $P<0.01$

charcoal-supplemented feed used on average 6.5% less feed per kilogram gain than the birds in the control group. We noticed a similar tendency in studies on charcoal supplementation of broiler chickens (Majewska et al., 1999), where 0.3% charcoal was also added to feeds. Edrington et al. (1997) using superactivated charcoal (SAC) in feeding broilers found that after only 21 days the chickens had 4.6% higher body weight. The authors attributed this effect to the presence of available microelements and the detoxicating effect of charcoal.

The influence of charcoal supplementation on survival is noteworthy (Table 2). Although no diseases were observed during the experiment, mortality of the control birds was 12.7%, whereas in the experimental group deaths were observed in only one repetition, which accounted for 0.98% of the entire group. Culling in this group was also lower and equaled 1% despite the density in it being greater because of lack of mortality. These results point to the beneficial effect of charcoal on the health of birds, which has a decisive impact on the economics of production and meat quality. The European Production Index for the control group was 393, whereas in the experimental group it was much higher and equaled 504 points.

The addition of charcoal did not significantly affect the results of carcass analysis, but did significantly increase the crude protein content in breast muscle by 0.44% ($P<0.05$) (Table 3).

Although the haematological and biochemical blood indicators did not differ significantly, a beneficial trend of added charcoal on the analyzed parameters was seen (Table 4).

TABLE 3

Chemical composition and physical and chemical properties of breast muscle of turkey-toms after 18th weeks

Indices	Groups		SEM
	I	II	
Dry matter, %	26.98	27.27	0.240
Crude protein, %	23.60[b]	24.04[a]	0.515
Crude fat, %	1.27	1.17	0.478
Crude ash, %	1.19	1.22	0.050
Water holding capacity, cm^2	6.73	7.19	1.562
Colour, %	24.50	23.83	2.103
pH 24 h	5.68	5.63	0.060

[a,b] – mean values in the rows with different letters were significantly different at $P<0.05$

TABLE 4

Haematological and biochemical indices of blood of turkeys at 18th week

Indices	Groups		SEM
	I	II	
Red blood cells, 10^{12}/l	2.13	2.19	0.061
White blood cells, 10^{9}/l	18.00	18.50	1.955
Haemoglobin, g/dl	10.07	11.30	0.616
Haematocrit, %	33.70	35.00	1.647
Glucose, mg/dl	180.00	170.60	28.218
Total protein, g/dl	4.16	3.78	0.385
Cholesterol, mg/dl	154.20	146.60	16.848

CONCLUSIONS

The addition of charcoal in an amount of 3 kg per ton of feed improved the performance of meat turkeys, reduced mortality and increased the crude protein content in breast muscles.

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STRESZCZENIE

Wpływ zastosowania dodatku węgla drzewnego na wyniki produkcyjne ciężkich indorów rzeźnych Big 6

Doświadczenie przeprowadzono na 204 ciężkich indorach rzeźnych Big 6. Jednodniowe pisklęta podzielono na dwie grupy żywieniowe, w każdej po trzy powtórzenia po 34 ptaki. Wszystkie ptaki żywiono jednakowymi granulowanymi mieszankami standardowymi w systemie 3-stopniowym. Ptaki grupy kontrolnej otrzymywały mieszanki bez dodatku, ptaki z grupy doświadczalnej z dodatkiem rozdrobnionego węgla z drzew liściastych, w ilości 3 kg/tonę zadawanej paszy. Węgiel drzewny podawano od pierwszego dnia życia przez cały okres odchowu.

Zastosowany dodatek węgla drzewnego wywarł korzystny wpływ na wyniki produkcyjne. Indory otrzymujące paszę z dodatkiem węgla drzewnego po 18 tygodniach odchowu były cięższe o 870 g, tj. o 5,9% i lepiej wykorzystywały paszę na 1 kg przyrostu, o 6,5%, w porównaniu z grupą kontrolną. Przeżywalność ptaków otrzymujących węgiel drzewny wynosiła 99%, kontrolnych 87,3%. W mięśniach piersiowych ptaków doświadczalnych istotnie zwiększyła się zawartość białka ogólnego. Wskaźnik Europejskiego Indeksu Produkcyjnego wynosił dla grupy kontrolnej 393, dla grupy otrzymującej dodatek węgla drzewnego 504 punkty.