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Response of Broiler Chickens to Wood Charcoal and Vegetable Oil Based Diets

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Abstract: An experiment was carried out to determine whether Wood Charcoal (WC) would affect growth performance, carcass characteristics and blood profiles of broilers and to determine whether Vegetable Oil (VO) supplementation would influence similar parameters in broiler chickens fed WC. Dietary WC was incorporated into broiler starter and finisher diets at 0, 2.5, 5.0 and 7.5% levels while diets containing 2.5 and 5.0%WC were each supplemented with 1.5%VO to make six dietary treatments. Results showed that feed intake (F1) was significantly increased in broilers fed 5% WC with or without VO while birds on other diets had similar ($p>0.05$) intake. Body Weight Gain (BWG) and feed conversion ratio (FCR) were significantly better ($p<0.05$) on birds fed without WC compared to those fed on WC based diets. Supplementation with VO only gave marginal improvement on performance indices when compared with the corresponding WC based diets without VO. However, the performance criteria used (F1, BWG and FCR) were still not commensurate to the control diet. Carcass yield, liver, spleen and kidney did not show any major variations ($p>0.05$) among dietary treatments while lung, heart and gizzard indicated significant differences ($p<0.05$). The packed cell volume, haemoglobin, red blood cell and white blood cell, MCV, MCH, MCHC values obtained for the six treatments were not statistically ($p>0.05$) different from each other. The present study appeared not to justify the dietary inclusion of WC in broiler chicken diets and its use in broiler diets is not recommended.

Key words: Wood charcoal · vegetable oil · broilers · growth performance · carcass yield · hematology

INTRODUCTION

In Nigeria and indeed many other countries, various feeds and additives are incorporated into poultry diets to ensure maximum productivity. Most of the additives are used depending on area and the ease of use. Moreover, most of these materials are not cited in the scientific literature but are used locally, for instance wood charcoal [4, 6]. It was reported by Kutlu *et al*. [4] that some local poultry producers in Turkey claimed that 20-50 g wood charcoal per kg diet prevents fatness and improve performance of broilers and layers. In view of these assertions, we have attempted to validate this claim in our laboratory because wood charcoal is widely available in Nigeria and so far, no reports can be cited as to its nutritional use apart from being a suitable and alternative cheaper source of generating heat.

The present study was therefore conceived to determine whether dietary wood charcoal applied at graded levels would influence growth performance, hematology and carcass characteristics and to determine whether Vegetable Oil (VO) supplementation would affect similar parameters in broiler chicken fed wood charcoal.

MATERIALS AND METHOD

Experimental diets and their composition: Wood Charcoal (WC) was obtained from a local market in Ogbomoso and ground through a mill to pass a 1mm sieve. As ground, it contained 946g DM/Kg, 154g ash/kg, 97.5g crude fibre/kg, 10.8g ether extract/kg, 19.6g crude protein/kg and 664.1 g nitrogen free extracts/kg. Six diets each were formulated during the starter (1-5 weeks) and finisher (5-9 weeks) phases. Diet I was designated as the control without WC while diets 2, 3 and 4 contained 2.5, 5.0 and 7.5% WC respectively. Diets 5 and 6 were formulated to contain 2.5 and 5.0% WC respectively each supplemented with 1.5% Vegetable Oil (VO). The diet composition for the two phases is shown in Table 1.

Experimental birds and management: A total of 200 unsexed Anak 2000 broiler chicks were procured from

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Table 1: Composition and nutrient contents of broiler starter and finisher diets (%)

	Starter diets						Finisher diets					
	1	2	3	4	5	6	1	2	3	4	5	6
Ingredients	0	2.5	5.0	7.5	2.5+VO	5.0+VO	0	2.5	5.0	7.5	2.5+VO	5+VO
Maize	52.7	49.7	43.7	47.7	47.8	44.9	58.4	55.4	53.4	49.4	52.5	49.5
Groundnut cake	30.6	31.1	31.6	32.1	31.5	32.0	25.4	25.9	26.4	26.9	27.3	27.8
Wood charcoal[a]	0.0	2.5	5.0	7.5	2.5	5.0	-	2.5	5.0	7.5	2.5	5.0
Vegetable oil	-	-	-	-	1.5	1.5	-	-	-	-	1.5	1.5
Fish meal	5	5	5	5	5	5	2.5	2.5	2.5	2.5	2.5	2.5
Wheat offal	8	8	8	8	8	8	10	10	10	10	10	10
Bone meal	2	2	2	2	2	2	2	2	2	2	2	2
Oyster shell	1	1	1	1	1	1	1	1	1	1	1	1
Salt	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Methionine	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Premix	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Analyses												
Dry matter	91.8	91.8	91.8	91.8	91.7	91.8	91.3	91.5	91.6	91.3	91.5	91.2
Crude protein	22.9	22.8	22.9	22.9	22.9	23.0	19.3	19.4	19.6	19.5	19.4	19.5
Ether extract	8.79	8.73	8.66	8.59	8.68	8.57	5.64	5.35	5.47	5.31	6.38	6.74
Crude fibre	3.46	3.50	3.52	3.56	3.46	3.49	4.84	4.05	4.25	4.65	4.28	4.15
Crude ash	3.47	3.66	3.86	4.05	3.67	3.86	2.85	2.96	2.39	3.14	2.94	2.59
NFE	53.2	53.1	52.9	52.7	53.0	52.9	59.5	59.8	58.6	58.6	58.4	58.2

[a]Wood charcoal contains (%); DM, 94.6, CP, 1.96; EE, 1.08; CF, 9.75; Ash, 15.4, NFE, 64.41

Farm Support Services, Ibadan and fed a commercial broiler starters mash (24%CP/2900 ME kcal/kg) for 1 week. Subsequently, one hundred and eighty birds were weighed and randomly allotted to the six dietary treatments in triplicate lots of 10 chicks each using the completely randomized design.

The six experimental starter and finisher diets were provided to the birds during the starter (1-5 weeks) and finisher (5-9 weeks) phases respectively. The groups were kept in a floor-littered poultry house situated at the University Teaching and Research farm, Ogbomoso. Feed and water were provided *ad libitum*. Other routine management practices such as vaccination, drug administration and maintenance of cleanliness in and out of the poultry house were applied.

Initial body weights of the birds were taken on replicate basis at the start of the study and thereafter on weekly basis. Weekly feed intake was also recorded. The mean daily weight gain, daily feed intake and feed to gain ratio were thus calculated from the data obtained during the starter, finisher and overall experimental period. On day 63, 2 birds of mean weight close to the average group weight were randomly selected from each of the 18 replicates and starved of feed for 12 hours in order to empty their crops. The birds were exsanguinated, defeathered, eviscerated and dressed. Each bird's carcass, cut-up parts and organs were separately weighed and expressed as a percentage of dressed weight. Blood samples were collected on the 63rd day of the trial from 3 birds per treatment during slaughter. The samples were collected in bottles containing ethylene tetra-acetic acid (EDTA) as anticoagulant. They were then taken to the laboratory for hematological analyses that included Packed Cell Volume (PCV), erythrocyte (red blood cell), leucocytes (white blood cell) and haemoglobin. The Mean Cell Volume (MCV), Mean Cell Haemoglobin (MCH) and Mean Cell Haemoglobin Concentration (MCHC) were calculated. The hematological parameters were determined as described by Davice and Lewis [2].

The proximate compositions of wood charcoal and experimental diets were determined according to AOAC [1]. Data collected were analyzed by analysis of variance technique and the Duncan's multiple range technique was used to detect differences among treatment means [8].

RESULTS AND DISCUSSION

The growth performance data of broiler chickens fed wood charcoal based diets supplemented with or without vegetable oil during the starter, finisher and overall experimental periods is shown in Table 2. At the starter

Table 2: Effect of providing wood charcoal and supplemental VO on growth, performance of broilers at starter, finisher and the overall experimental period

Variable	Control	2.5%WC	5%WC	7.5%WC	2.5%WC+VO	5.0%WC*VO	SEM
Days 7-35							
BWG (g/b)	20.5[a]	19.5[a]	22.4[a]	17.3[b]	22.2[a]	21.4[a]	0.95
Feed intake (g/b)	48.6[b]	50.9[b]	54.0[a]	49.0[b]	50.5[b]	51.0[b]	1.44
FCR(F1/BWG)	2.37[c]	2.61[b]	2.41[c]	2.84[a]	2.73[b]	2.38[c]	0.46
Days 35-63							
BWG	50.3[a]	44.5[b]	42.6[b]	41.8[b]	44.7[b]	44.5[b]	1.30
Feed intake	129.2[b]	127.9[b]	135.4[b]	122.4[c]	127.4[b]	132.3[a]	2.55
FCR	2.57[c]	2.87[b]	3.18[a]	2.93[a]	2.84[b]	2.97[a]	0.12
Days 7-63							
BWG	35.3[a]	32.0[b]	32.5[b]	29.6[b]	33.5[b]	33.0[b]	0.60
Feed intake	88.8[b]	89.4[b]	94.7[a]	85.7[c]	88.8[b]	93.2[a]	2.06
FCR	2.52[b]	2.79[1b]	2.91[a]	2.90[a]	2.65[c]	2.68[c]	0.07

a, b, c: Means within a row with similar superscripts are not significantly different (p>0.05)

Table 3: Effect of dietary charcoal wood on carcass weight, carcass yield, cut-up parts and organ weights of broilers

	Diets						
	0%WC	2.5%WC	5%WC	7.5%WC	2.5%WC+P0	5%WC+P0	
Variable	1	2	3	4	5	6	SEM
Carcass							
Carcass weight (g/b)	1445.3[a]	1260.4[b]	1303.1[ab]	1155.3[c]	1470.8[a]	1387.9[a]	28.02
Carcass yield (%)	73.1[a]	70.3[a]	71.6[a]	69.7[b]	78.4[a]	75.1[a]	0.34
Abdominal fat (%)	0.95[a]	0.65[b]	0.61[b]	0.54[c]	0.69[b]	0.71[b]	0.09
Relative cut-up parts (% of CW)							
Wing	12.7	12.6	11.4	11.5	11.8	11.5	0.79
Thigh	19.2	16.7	22.9	19.2	19.0	17.1	0.30
Drum stick	14.6	13.7	14.8	15.1	14.7	15.7	0.47
Breast	25.3	25.3	27.6	25.1	24.4	24.5	0.35
Back	18.9	21.4	19.4	19.2	19.9	20.8	0.24
Neck	6.96	6.96	6.90	7.03	7.89	7.07	0.07
Relative organ weights (% of CW)							
Liver	2.17	2.3	2.23	2.46	1.95	2.41	0.07
Kidney	0.51	0.97	1.0	0.98	0.83	0.96	0.04
Lung	0.54	0.74	0.66	0.74	0.73	0.73	0.02
Heart	0.54	0.57	0.47	0.53	0.42	0.50	0.01
Spleen	0.12	0.11	0.11	0.23	0.07	0.11	0.12
Gizzard	2.72	3.30	2.39	2.80	2.60	2.51	0.72

phase, feed intake was highest (p<0.05) for broilers on 5% WC diet while other treatments had similar intake. Body weight gain was similar across the dietary groups with the exception of broilers fed 7.5% WC based diets. Feed/gain ratio was significantly (p<0.05) better for birds fed on the control diet, 5% WC and 5% WC+VO diets compared to the other dietary groups however, broilers fed on 7.5% WC had the worst feed conversion ratio.

During the finisher phase, birds fed the control diet significantly (p<0.05) gave the highest BWG. Broilers on 5% WC with or without VO had the highest (p<0.05) feed consumption while the least intake was recorded for birds fed 7.5% WC diet. The control diet exhibited the best-feed conversion ratio.

Considering the overall feeding period (combined starter/finisher phases), feed intake was significantly increased in broilers fed 5% WC with or without VO while birds fed 7.5%WC diet had the least (p<0.05) consumption. Body Weight Gain (BWG) and Feed Conversion Ratio (FCR) were significantly better (P<0.05) on birds fed the control diet compared to those fed WC based diets without VO. The increase in feed consumption for birds fed 5%WC did not really translate to higher weight gain. However, the slight improvement in weight gain observed with the addition of VO is a reflection of the positive attributes of vegetable oil in poultry diets. Vegetable oil increases energy density, reduces dustiness and increase vitamin A concentration in diets [7, 9].

Charcoal supplementation was reported to induce a small reduction in feed intake, egg production and feed conversion ratio [4]. The reduction in feed intake was

Table 4: Effect of dietary wood charcoal and supplemental vegetable oil on hematology of broilers

	Diets						
Variables	1	2	3	4	5	6	SEM
Packed cell volume (%)	29.00	26.50	25.50	24.50	26.00	25.00	0.24
Haemoglobin (gm %)	9.67	8.83	8.50	8.17	8.60	8.33	0.124
Red blood cell $x10^6$	4.83	4.42	4.25	4.05	4.30	4.15	0.58
White blood cell $x10^3$	8.83	9.03	9.95	9.60	6.23	6.35	0.57
Mean cell volume	59.90	60.00	60.00	60.60	60.50	60.40	0.58
Mean cell Haemoglobin	3.33	3.33	3.33	3.33	3.31	3.33	0.003
Mean cellHaemoglobin concentrations	199.90	199.90	200.00	201.80	200.00	201.20	1.89

attributed to a higher bulk density of charcoal which was why VO was included in diets 5 and 6 to reduce bulkiness and dustiness. The blackening of the feed by the charcoal might cause a degree of unpalatability [3]. This might account for the significant reduction in intake for broilers on 7.5% WC. Previous studies [5, 6] opined that the use of charcoal had a beneficial effect on the development of chickens and turkeys. For instance [5] observed that after 7 weeks of growth, birds which received supplemental charcoal were about 1-6.5% heavier, had a 5.9% better feed conversion efficiency and a 1.6% better survival rate than the control group without wood charcoal. Similarly, Majewska *et al*. [6] reported that turkeys given charcoal supplemental feeds were 5.9% heavier and had a 6.5% better feed conversion ratio than the control birds. Survival in the groups that received charcoal was 99% as compared to the 87.3% in the control group.

The carcass yield, cut-up parts and organ weights of broilers fed WC and supplemental vegetable oil diets are shown in Table 3 while the hematological indices are indicated in Table 4. Broiler chickens fed 7.5%WC had the least percentage carcass yield and abdominal fat among the dietary groups. Broiler cut-up parts and hematological parameters did not exhibit any major discernible response with the use of WC or supplemental VO in their diets. However, the lung, heart and gizzard showed slight ($p>0.05$) changes among the dietary groups. These showed that wood charcoal used in this study had no major physiological effects on tissue or organ development and functions. However a positive development is the reduction in the abdominal fat deposition in broilers fed WC based diets relative to the control group.

This pilot study reported here demonstrated that the wood charcoal incorporated into broiler chicken diet did adversely affect broiler performance during the entire feeding period as opposed to reports by Kutlu *et al*. [4] Majewska and Zaborowski, [5] Majewska, *et al*. [6]. So, using WC in broiler diets is not recommended.

REFERENCES

1. AOAC. 1990. The official methods of analysis. Association of Official Analytical Chemists, 13th Edn. Washinghton DC.
2. Davice, J.U. and S.M. Lewis, 1991. Practical haematology 8th edition. Longman Ltd London, pp: 22-48.
3. Jindal, N., S.K. Mahipal and N.K. Mahajan, 1994. Toxicity of aflatoxin B3 in broiler chicks and its reduction by activated charcoal, Res. Vet. Sci., 56: 37-40.
4. Kutlu, H.R., I. Unsal and M. Gorgulu, 2001. Effect of providing dietary wood (oak) charcoal to broiler chicks and laying hens. Anim. Feed Sci. Tech., 90: 213-226.
5. Majewska, T. and M. Zaborowski, 2003. Charcoal in the nutrition of broiler chickens. Medycyna Weterynaryjina, 59: 81-83.
6. Majewska, T., D. Pyrek and A. Faruga, 2002. A note on the effect of charcoal supplementation on the performance of Big 6 heavy tom turkeys. J. Anim. Feed Sci., 11: 135-141.
7. Odunsi, A.A. and A.A. Onifade, 1998. Effect of zinc bacitracin supplementation of broiler chick diets containing a low or high vegetable oil concentration in the tropics. Trop. Vet., 16: 51-57.
8. Steel, R.G.D. and J.H. Torrie, 1980. Principles and procedures of statistics. A biometrical approach. 2nd edition McGraw Hill Books Co., New York, USA
9. Zollitscha, W., W. Knausa, A. Aichinegera and F. Lettnera, 1997. Effects of different dietary fat sources on performance and carcass characteristics of broilers. Anim. Feed. Sci. Technol., 66: 283-287.