Journal of Agricultural and Crop Research
Vol. 2(5), pp. 83-87, May 2014
ISSN: 2384-731X
Research Paper

Carcass yield, organoleptic and serum biochemistry of broiler chickens fed activated charcoal

E. Z. Jiya*, B. A. Ayanwale, A. B. Adeoye, P. S. Kolo, D. N. Tsado and O. J. Alabi

Department of Animal Production, Federal University of Technology Minna, Niger State, Nigeria.

*Corresponding author. E-mail: ez_jiya@yahoo.com.

Accepted 15th April, 2014

Abstract. Two hundred and twenty five (225) unsexed Marshal Broiler chicks were used to investigate the carcass yield, organoleptic and serum biochemistry of broilers fed activated charcoal. The broiler chicks were randomly allotted to five dietary treatments, supplemented with activated charcoal at 0, 0.5, 1, 1.5 and 2% and designated as T1, T2, T3, T4 and T5, respectively. Each treatment was grouped in three replicate with 15 birds per replicate. At the end of 8 weeks experimental period, a total of 15 broiler chickens were used for both carcass and blood analysis with three birds per treatment. Data was collected on carcass characteristics, sensory evaluation, and blood serum cholesterol. There were significant ($P < 0.05$) differences in the values of dressed weight, eviscerated weight, gizzard, abdominal fat, heart and spleen, while other carcass parameters were not significantly ($P > 0.05$) different. The result of the sensory evaluation were significant in all the parameters measured, while the serum biochemical analysis showed that SGOT (serum glutamine oxaloacetic transminase, SGPT (serum glutamine phosphates transminase), albumin, cholesterol and triglycerides were significantly ($P < 0.05$) different except alkaline phosphates and SGPT that were not significantly different. However, activated charcoal would serve as a good source of growth promoter for broiler birds to improve feed efficiency and their health. It is therefore concluded that at 0.5% activated charcoal supplementation increased relative organ weights, reduced cholesterol level of the broiler meat as a result or efficient mineral intake and nutrient utilization due to the absorptive effect of the activated charcoal.

Keywords: Carcass, serum, activated charcoal, broilers.

INTRODUCTION

In the poultry sector, feed remains the most important component of the cost of production. Hence researchers are continuously looking for ways to minimize feed cost, while improving poultry performance. One of the ways has been the use of growth promoters to improve feed efficiency and poultry health (Jean, 2010). There were many advantages of adding charcoal to animal diets as it controls lactic acid concentration in the gastrointestinal tract of ruminant, maintaining of pH level and micro flora in the rumen of steers (Ghosh et al., 1991) moreover, and pathogenicbacteria was controlled by charcoal (Nikoleavia et al., 1994). 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 closed depending on area and the ease of use. Moreover, most of these materials are not cited in scientific, but are used locally, for instance wood charcoal per kg diet prevents fatness and improve performance of broilers and layers. According to Ayanwanle et al. (2006) that pullets fed activated charcoal were high in economic returns and this results were attributed to increase mineral intake and utilization enhanced by charcoal supplementation and also improved absorption capacity of charcoal for dietary fat. The health of the gut is one of the major factors governing the performance of birds and thus, the economics of poultry production and the profile of intestinal micro flora play an important role in the gut health (Ayanwale et al., 2006). Therefore a stable gut micro flora predominantly made of lactic acid producing

Table 1. Composition of the basal diets.

Ingredient	Starter phase (%) 1-4 weeks	Finisher phase (%) 5 – 8 weeks
Maize	51.63	59.67
Soybean meal	18.82	14.27
GNC	17.21	13.10
Fish	4.00	3.00
Wheat offal	2.62	5.00
Bone meal	2.00	2.00
Oyster shell	1.00	1.00
Premix	0.30	0.30
Dl- Methionine	0.20	0.20
L-Lysine Hydrochoride	0.20	0.20
Salt	0.30	0.30
Palm oil	2.00	1.00
Total	100	100

bacterial and protecting the host from pathogenic invasion or toxic substance is a pre-requisite for gut health and adequate growth performance. Charcoal as enormous absorptive properties, it acts curatively on the gastrointestinal tract, absorbing gases such as hydrogen sulfide and ammonia that are formed there, bacterial toxins as well as mycotoxins produced by fungi (Edrington et al., 1998).

Charcoal is not digested in the gastrointestinal tract, and it binds various substances through physical interactions regardless of whether they are ionized or not. By binding of ammonia, charcoal protects the intestine against alkalization. The mineral contained in charcoal form bases with water lower the surface tension of the digesta and emulsify fat, therby supporting liver funtion and enabling digestion and assimilation (Majewska et al., 2011). Therefore, the objectives of this study are to investigate the effect of activated charcoal diets on the carcass characteristics, serum biochemistry and sensory evaluation of broiler chickens.

MATERIALS AND METHODS

Two hundred and twenty five (225) day old unsexed broiler chicks (Marshal Breed) were used for this study which lasted for 8 weeks. The birds were brought from a veterinary shop along Yoruba road, Mobil, Niger State. Niger State is located between latitude 9°3′ and 9°45′ North and longitude 7°31′ and 6°45′ East. Its mean annual rainfall is between 900 and 1,100 mm and a growing season of 190 to 220 days. Five diets were formulated to represent five treatments and the diets consist of coconut shell charcoal powder at varying proportions after activation from a mud bakery furnace and grinded to pass through 0.02 mm sieve as prescribed by (Ayanwale et al., 2006). Table 1 contained the diets. Treatment 1 (control diet) with 0% activated coconut shell charcoal supplementation while treatments 2, 3, 4 and 5 contains 0.5, 1, 1.5 and 2% activated coconut shell charcoal supplementations respectively. The diets formulated were isocaloric and isonitrogenous. The birds were managed under a deep liter system with 5 treatment groups and three replicates per treatment. Thus, 15 floor pens (1.5 m^2/pen) were used. Fifteen chicks were randomly allotted to each replicate in a complete randomized design arrangement. The housing system for the experiment was intensive. The birds were managed purely on concrete floor with wood shavings on it, demarcated with wire mesh. The pen was thoroughly cleaned and disinfected before the commencement of the experiment. Heat was provided for the chicks during the brooding period with the use of charcoal pot and electric bulbs which were lit every evening and left all night. Vaccination and medication programme were strictly adhered to. Other routine management procedures included, weighing of birds on arrival before the commencement of the experiment and subsequently at weekly intervals. Feed and clean water were supplied *ad libitum*. Records of mortality, weight changes and feed intake were kept. The daily operation performed includes removal of left over feeds, cleaning of the drinkers and replacing the feeder and drinker with new feed and water (Table 1).

Calculated values

Crude protein 24.0 1%, Metabolizable energy 3150 ($kcalkg^{-1}$). Each 2.5kg contain vita. A – 10,000,000 iu:, vita. D-2,000,000iv, vit. E- 20,000iv, vit. k- 2,250 mg; thiamine – 170 mg; 12iboflavin – 5,000 mg; Pyridoxine – 2,750 mg; Niacin- 27,500 mg; vit B12-15 mg; Pantothenic acid – 7,500 mg; folic acid – 7,500 mg; Biotin – 50 mg; manganese – 80 g; zinc – 50 g; copper – 5 g; iodine 1.5 mg; selenium – 200 mg and cobalt – 200 mg.

Activated coconut shell charcoal supplementation (starter and finisher phase) at 0, 0.5, 1, 1.5, and 2% per

100 kg of diet.

Carcass characteristics

The carcass characteristics were determined at the end of the experiment by selecting randomly, two birds from each replicate. The selected birds were starved of feed and water over night. Before slaughtering, the individual weight of the birds was recorded. Thereafter, the birds were slaughtered by cutting the jugular vein around the neck. The birds were immediately scalded in warm water and the feathers were manually removed. Thereafter, the fully dressed weights of the carcasses was taken and recorded. The carcasses were then separated into breast, back, upper back, thigh, shank, neck, arm, wing, drumstick, head and the internal organs (viscera). The parts were individually weighed and the weights were expressed as percentage of the live weight of the carcass. In addition, the length of the intestine of each carcass was taken and recorded. The dressing percentage and percentage weight of body in relation to the live weights of the birds were calculated using the formula below:

$$\text{Dressing percentage} = \left(\frac{\text{carcass weight}}{\text{Live weight}}\right) \text{x } 100$$

$$\text{Percentage of body cut} = \left(\frac{\text{Weight of body cut}}{\text{Live weight}}\right) \text{x } 100$$

Serum biochemical analysis

At the end of 8 weeks of age, sets of blood samples were taken from all the animals via jugular venipuncture using a 20 gauge syringe. The blood samples (10 ml) was collected into anti-coagulant free plastic tubes, allowed to coagulate at room temperature for 30 min and centrifuged for 10 min at 3000 rmp (Laessig et al., 1976). The supernatant sera were then stored at -20°C for subsequent biochemical analysis. Serum concentration of alkaline phosphates (ALKP), serum glutamic oxaloacetictransminase (SGOT), SGPT, albumin cholesterol and triglyceride were determined using using a clinical chemistry analyzer Olympus AU 640 (Olympus Deutschland GmbH, Hamburg, Germany).

Sensory evaluation

Equal parts of the breast, drumsticks, thigh, neck and wings were collected from the carcasses of the birds of the five treatment groups. The meat samples were salted, wrapped individually in aluminum foil, labeled and cooked in a gas cooker for 15 min. The cooked meat samples from the same carcass were placed in flat enamel plates numbered based on the dietary treatment of each carcass and displaced on a long table for the panelist to asses. The mouth of the individuals was properly rinsed after biting each meat samples for accurate and precise scoring. The parameters on which the meat samples were evaluated are colour, texture, flavor, juiciness, tenderness and overall acceptability.

Statistical analysis

Data obtained from the experiment were subjected to analysis of variance (ANOVA) (SAS, 1998). The variations in means were separated using the Duncan Multiple Range Test (Duncan, 1955).

RESULTS AND DISCUSSION

The result of carcass characteristics of broilers fed activated coconut charcoal (Table 2) revealed non-significant ($P > 0.05$) in all the parameters measured except the result of the dressed weight which were statistically (P 0.05) different among the treatments. The dressed weight (g) showed that the broiler birds fed 0.5% supplemented activated coconut charcoal although similar to those fed 0, 1 and 1.5% respectively, differ significantly from those supplemented 2% activated coconut charcoal. This might be that the inclusion of activated coconut shell charcoal at 0.5% had an effect on the relative live weight of the birds which might be as a result of increased body weight gain; the same result was reported by Kutlu et al. (2000).

Table 3 showed the result of visceral organs of broiler chickens fed activated coconut shell charcoal. The result revealed significant ($P < 0.05$) difference in the abdominal fat, gizzard, heart and spleen were statistically different ($P < 0.05$) among the treatment means. Birds fed 1.0% activated coconut shell charcoal had higher abdominal fat compared to other treatments. The result is not in line with the reports of Edrington et al. (1998). The authors reported that abdominal fat was heavier in birds fed at 2.0%. The results of gizzard and spleen followed the same pattern 0.5% activated coconut shell charcoal had higher values compared to all other treatments which are similar. This result corroborates the results of Majewska et al. (2011). The authors concluded that feeding activated charcoal could be the reason for the largeness of the gizzard. The higher heart value recorded in the broiler chickens fed 2.0% activated coconut charcoal might be linked to the high serum glutamic oxaloacetic transaminase observed in the same treatment. This might be due to high absorption capacity of toxins and fat soluble. The result is in line with Kutlu et al. (2001). The authors reported that activated charcoal absorb toxins.

The result of the sensory evaluation of broiler meat samples (Table 4) showed that colour, tenderness, juiciness, flavour and the overall acceptability were significantly ($P < 0.05$) affected by the inclusion levels of

Table 2. Carcass characteristics of broilers fed activated coconut shell charcoal.

Parameter	T1	T2	T3	T4	T5	SEM
Live weight (g)	2150	2350	2200	2090	1980	52.58
Dressed weight (g)	1735^{ab}	1922^{a}	1735^{ab}	1633^{ab}	1520^{b}	52.09
Dressing (%)	81.05	81.72	78.85	82.89	76.83	1.22
Wings (%)	9.10	11.77	9.84	7.66	8.63	0.50
Back (%)	10.07	11.77	9.97	10.12	10.09	0.24
Head (%)	2.28	3.27	3.14	2.02	2.81	0.24
Thigh (%)	7.49	13.05	10.07	8.23	9.52	0.85
Shank (%)	4.56	5.23	5.67	4.62	4.59	0.31
Drumstick	8.63	9.17	9.42	7.09	8.63	0.62
Neck (%)	5.69	7.20	6.90	5.19	6.49	0.59
Breast (%)	16.54	13.08	18.62	13.69	13.44	1.15

$^{a-b}$ Means on the same row having different superscript are significantly ($P < 0.05$) different.
T_1 -0% activated charcoal supplementation. T_2-0.5% activated charcoal supplementation.
T_3 -1% activated charcoal supplementation. T_4-1.5% activated charcoal supplementation.
T_5 .2% activated charcoal supplementation. SEM – standard error of mean

Table 3. Visceral organs of broilers fed activated coconut shell charcoal (%).

Parameter	T1	T2	T3	T4	T5	SEM
Abdominal fat	1.34^{c}	1.30^{c}	1.76^{a}	1.68^{ab}	1.41^{bc}	0.07
Gizzard	2.72^{ab}	3.13^{a}	2.52^{ab}	2.02^{b}	2.43^{ab}	0.14
Liver	2.18	2.35	2.39	2.11	2.22	0.10
Heart	0.24^{b}	0.55^{ab}	0.58^{b}	0.46^{ab}	0.47^{ab}	0.05
Crop	1.92	2.48	2.39	2.11	2.22	0.09
Intestine	7.49	7.84	8.31	7.09	7.62	0.39
Kidney	0.26	0.29	0.32	0.28	0.29	0.01
Spleen	0.08^{b}	0.12^{a}	0.11^{ab}	0.09^{ab}	0.11^{ab}	0.09
Lungs	0.52	0.61	0.59	0.41	0.52	0.03

^{abc}Means with different superscript on the same row are significantly ($P < 0.05$)
T_1 -0% activated charcoal supplementation. T_2-0.5% activated charcoal supplementation.
T_3 -1% activated charcoal supplementation. T_4-1.5% activated charcoal supplementation.
T_5 .2% activated charcoal supplementation. SEM – standard error of mean

Table 4. Sensory evaluation of the sample of broiler chickens (cooked for 15 min) fed activated coconut shell charcoal.

Parameter	T1	T2	T3	T4	T5	SEM
Colour	8.35^{a}	8.45^{a}	8.20^{ab}	87.90^{b}	7.75^{c}	0.07
Tenderness	8.65^{a}	8.40^{a}	8.30^{a}	7.55^{b}	7.40^{b}	0.07
Juiceness	8.35^{a}	8.30^{a}	8.10^{b}	7.45^{b}	7.75^{b}	0.08
Flavour	8.70^{a}	8.40^{a}	7.85^{b}	8.30^{a}	7.50^{b}	0.08
Overall acceptability	8.65^{a}	8.25^{a}	8.55^{a}	7.65^{b}	7.70^{b}	0.17

^{abc} Means with different superscript on the same row are significantly ($P < 0.05$)
T_1 -0% activated charcoal supplementation. T_2-0.5% activated charcoal supplementation.
T_3 -1% activated charcoal supplementation. T_4-1.5% activated charcoal supplementation.
T_5 .2% activated charcoal supplementation. SEM – standard error of mean

activated charcoal among the treatment groups and this might be as a result of the fiber content of the activated charcoal which is in line with (Afzal and Zahid, 2004) who stated that dietary fiber can impart some functional properties to foods, e.g., increase water holding capacity, oil holding capacity, emulsification and/or gel formation, modify textural properties and improve shelf-life.

The blood parameters showed significant ($P < 0.05$) differences in the alkaline phosphates (ALKP), SGOT, triglyceride and albumin level in the liver profile (Table 5).

Table 5. Serum constituents and biochemical parameters of broilers fed activated coconut shell charcoal.

Parameter	T1	T2	T3	T4	T5	SEM
Alkaline phosphate (iu/L)	73.45	61.75	72.85	76.85	71.25	2.18
SGOT (iu/L)	59.35^{b}	95.80^{a}	64.25^{b}	57.95^{b}	98.95^{a}	6.38
SGPT (iu/L)	22.70	21.40	22.65	14.20	13.50	1.77
Albumin (g/dl)	31.00^{ab}	26.00^{b}	30.50^{ab}	33.00^{ab}	26.50^{ab}	0.11
Cholesterol (mmol/L	120.85^{a}	119.20^{ab}	101.75^{ab}	95.50^{b}	90.95^{ab}	2.45
Triglyceride (mmol/L)	110.05^{ab}	89.05^{b}	101.30^{ab}	135.70^{a}	80.95^{b}	7.38

^{ab} Means with different superscript on the same row are significantly (P<0.05)
SGOT = serum glutamic oxaloacetic transaminase
SGPT= serum glutamic phosphate transaminase
T_1 -0% activated charcoal supplementation. T_2-0.5% activated charcoal supplementation.
T_3 -1% activated charcoal supplementation. T_4-1.5% activated charcoal supplementation.
T_5 .2% activated charcoal supplementation. SEM – standard error of mean

The birds fed % activated coconut shell charcoal had lower cholesterol level compared to the control group and might be that activated charcoal absorbed fats soluble substances. The result is in line with those of kutlu et al. (2000) who stated that activated charcoal is an absorbent for many toxins, gases, drugs, and fat soluble substances without any specific action.

CONCLUSION

In conclusion, from this study, it can be concluded that at 0.5% activated coconut shell charcoal supplementation, there was increased relative organ weight, reduce cholesterol level of the broiler meat as a result or efficient mineral intake and nutrient utilization due to the absorptive effect of the activated charcoal.

REFERENCES

Afzal M, Zahid A (2004). Effect of addition of a mycotoxindetoxiter in poultry feed containing different levels aflatoxin on the performance of broiler. Asian – Aust. J. Amin. Sci. 17 (7):990-994.

Ayanwale BA, Lanko AG, Kudu YS (2006). Performance and egg quality characteristics of pullets fed activated shea butter charcoal based diet. In. J. poult. Sci. 5(10):927-931.

Duncan DB (1955). Multiple Range and Multiple F Test Biometrics 11:1-42

Edrington TS, Kubena LF, Harley RB, Rotinghaus GE (1998). Influence of super activatedcharcoal on the toxic effect of aflatoxin or T-2 toxins in growing broilers. Poult. Sci. T.76:1205-1211.

Ghosh K, Yamamoto NT, Sako T, Koyama H, Motoyoshi (1991). Effects of activated charcoal on intraruminal lactic acid. Bull. Nippon. vet. 40:22-28.

Jean RK, Alexis T, Berrain MM, Joseph T, Berrain, Joseph T (2010). Growth performance and carcass characteristics of broiler chickens fed diet supplemented with graded level of charcoal from maizecob or seed of canarium schwein furtii engl.Tropanimal health prod. 43:51-56.

Kutlu HR, Unsal I, Gorgulu I (2000). Effect of providing directory wood (oak) charcoal to broiler chicks and laying hens. Anim. Feed sci. Tecnol. Elsevier 90:213-226.

Majewska T, Pudyszak K, Kozlowski K (2011). The effect of activated charcoal additionto diets for broiler on peerformance and carcass parameters. Poult Sci. T. 55.P.77

Nikoleavia I, Grigor'e AV, Znamenskill KV (1994). An experiment study of enterosorbents in salmonellosis.Zh. Microbial. Epedemol. Immunobiol. 2:7-7

SAS (1998). Statistical Analysis System Institutes. *User's guide. SAS Institute Inc. Cary, N. C*.