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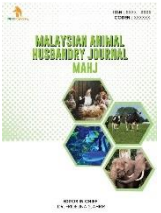

RESEARCH ARTICLE

CARCASS EVALUATION AND ORGAN WEIGHT OF BROILERS FED DIETS CONTAINING WOOD CHARCOAL AT DIFFERENT LEVELS OF INCLUSION

Nwokolo, P.C., Ebenebe, C.I*.

Nnamdi Azikiwe University, P.M.B 5025, Awka, Anambra State.
Corresponding author email: ci.ebenebe@unizik.edu.ng

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ABSTRACT

The study evaluates the influence of wood charcoal on carcass parameters and organ weights of broilers in a feeding trial. 120 Ross 308 broilers of both sexes gotten at one day-old were randomly allocated to four treatments with three replicates of 10 birds each, in a completely randomized design arrangement. They were fed diets containing wood charcoal at T1(0%), T2(2.5%), T3(5%), and T4(7.5%) levels of inclusion in a two-staged system (Starter and Finisher). At the end of rearing period, the result showed that carcass parameters and organ weight were significantly (P<0.5) enhanced by the dietary treatments, where the highest mean of live weight, bled weight, defeathered weight, shank, thigh, neck, gizzard, liver, lungs, pancreas, small intestine, proventriculus, and spleen weight were found at T2 (2.5%). It was concluded that addition of wood charcoal at 2.5% gave the best result for carcass parameters and organ weight.

KEYWORDS

Carcass, Broilers, Organ Weight, Wood Charcoal

1. Description of Problem

The protein intake level of humans in most developing countries including Nigeria is very low due to the high cost of the product (Abeke et al., 2003). The animal protein deficiency in the country is further aggravated by high level of population growth of which the world's population stands at 7.3 billion people currently, with a projection to be nine billion by 2050 (FAO, 2012). This high population has continued to put pressure on the existing animal protein coupled with high cost of producing them. Adedeji *et al.* stated that the estimated daily minimum animal protein requirement of an adult in Nigeria vary between 65 and 85 per person, Food and Agricultural Organization (FAO) recommended consumption of 34g of animal protein per person per day for normal growth and development although recommended that 35g of the minimum protein intake per day should be obtained from animal products (Adedeji et al., 2015; FAO, 1991; Oloyede, 2005). These figures are hardly maintained and opined that this is as a result of high poverty level and ignorance (Ebenebe and Okpoko, 2015).

Boosting the production of broiler chicken so as to attain maximum weight in short interval is an alternative means of alleviating the deficiency of animal protein in Nigeria. Broilers are fast growing birds and efficient converters of feed to animal protein. At maturity (6 - 8 weeks), well managed broilers could attain market weight of between 1.16 - 2.00kg, (Oluyemi and Robert, 2000). The success of broiler production manifests on maximum weight gain within minimum period and this could be achieved through proper nutrition and good management practices. The livestock industry is having difficulties in meeting the demand for animal feeds which accounts for about 70% of the cost of production enterprise and this high feed cost increases the overall cost of production for poultry keepers which could negatively affect its economic sustainability (Sumberg et al., 2017). As a result, researchers are continuously looking for ways to minimize inputs majorly the feed cost, while improving on the output - poultry performance. One of the means of reducing feed cost is to increase the efficiency of feed nutrient and opined that growth promoters have been used to improve feed efficiency and poultry health (Jean et al., 2010).

Charcoal has been proposed as feed additive to stimulate feed intake and digestion, thereby enhancing growth performance of broiler chicken in Iran, Cameroon and Poland (Kana et al., 2011; Majewska et al., 2011; Khadem et al., 2012). According to a study, 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. In pigs, it has been demonstrated that charcoal reduces fecal gas emission, and hence might be an option to reduce negative environmental effects of pig production (Ayanwale et al., 2006; Chu et al., 2013). Finally, charcoal has a good adsorption capacity of toxins and therefore has the potential to improve birds' health (Khadem et al., 2012; Rafiu et al., 2014). Charcoal has no nutritive value and may cause constipation if fed in excess. In goat, demonstrated that the fecal consistency changed from normal to hard when goats consumed diets with over 5% active charcoal (Quaranta et al., 2013). Furthermore, the fecal nitrogen content decreased while its carbon content increased with higher levels of supplemented activated charcoal. Charcoal's favorable influence on increasing the body weight of broiler chickens, their survival and feed utilization has been described by (Majewska et al., 1999; Majewska and Zaborowski, 2003; Majewska and Siwik, 2006). This research was therefore aimed at ascertaining whether wood charcoal added at different levels would influence carcass characteristics and organ weight in broilers.

2. Materials and Methods

One hundred and twenty, unsexed Ross 308 breed of broiler were used for this study from one day old. The study lasted for eight weeks. The birds were brought from Agrited Hatchery and transported to experimental site at Nnamdi Azikiwe University, Latitude 6° 5' 10.1"N and Longitude 7° 08'31.9" E. Four diets were formulated to represent four treatments and the diets consist of charcoal powder at varying levels of inclusion. Tables 1 and 2 contained the diets formulation for starter and finisher feeds respectively. Treatment 1 (control diet) with 0% charcoal added while treatments 2, 3, and 4 has charcoal added at 2.5%, 5%, and 7.5% respectively

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Table 1: Gross and chemical composition of broiler starter diet

INGREDIENTS	T1 (0%)	T2 (2.5%)	T3 (5%)	T4 (7.5%)
Maize	50.00	48.10	45.00	40.50
Soyabean Meal	25.00	23.90	24.00	25.00
Wheat Offal	1.00	0.10	0.10	1.00
Fish Meal	3.00	3.50	4.00	3.00
Groundnut Cake	15.00	15.60	15.00	16.00
Wood charcoal	0.00	2.50	5.00	7.50
Palm Oil	2.00	2.30	2.90	3.70
Bone meal	2.00	2.00	2.00	200
Limestone	1.00	1.00	1.00	1.00
Methionine	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25
Salt	0.20	0.20	0.20	0.20
Vit. Premix	0.30	0.30	0.30	0.30
ME	3005.00	3004.95	3003.30	30006.33
Crude Protein	21.27	21.33	21.21	21.01
Crude Fibre	5.00	5.32	5.72	5.90
Crude fat	4.00	4.00	3.98	3.67
Ash	12.05	13.26	13.11	14.67
Nitrogen Free Fibre	54.48	53.18	53.27	52.20
Dry Matter	96.80	97.10	97.29	97.45
Moisture	3.20	2.90	2.71	2.55

Vit. Premix supplied the following per kilogram of diet: Mn, 120 mg: Zn, 100 mg; Cu, 10 mg; I, 2.5 mg; Ca, 135 mg; Fe, 75 mg; Se. 0.15 me.

Table 2: Gross and chemical composition of broiler finisher diet

INGREDIENTS	T1 (0%)	T2 (2.5%)	T3 (5%)	T4 (7.5%).
Maize	60.00	60.00	59.20	56.50
Soyabean Meal	8.00	7.00	6.00	6.50
Wheat Offal	4.00	1.90	0.10	0.10
Fish Meal	3.00	3.70	4.30	4.90
Groundnut Cake	20.00	20.00	20.70	20.00
Wood charcoal	0.00	2.50	5.00	7.50
Palm Oil	1.00	1.40	0.70	0.50
Bone meal	2.00	2.00	2.00	200
Limestone	1.00	1.00	1.00	1.00
Methionine	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25
Salt	0.20	0.20	0.20	0.20
Vit. Premix	0.30	0.30	0.30	0.30
ME	2900.22	2900.34	2902.01	2900.94
Crude Protein	18.97	18.67	18.72	18.88
Crude Fibre	5.20	5.00	5.98	6.25
Crude fat	3.69	3.92	4.40	4.82
Ash	10.31	12.89	14.20	14.52
Nitrogen Free Fibre	57.93	57.15	54.02	52.43
Dry Matter	96.10	97.58	97.32	96.90
Moisture	3.9	2.42	2.68	3.10

Vit. Premix supplied the following per kilogram of diet: Mn, 120 mg: Zn, 100 mg; Cu, 10 mg; I, 2.5 mg; Ca, 135 mg; Fe, 75 mg; Se. 0.15 me.

The birds were weighed and randomly allotted to the four (4) dietary treatments replicated three (3) times with each replicate having ten (10) birds in a completely randomized design (CRD), managed under a deep liter system with 4 treatment groups and three replicates per treatment, each of the replicates having 10 birds. The statistical model is Completely Randomized Design (CRD)

Yij = U + Ti + eij

Where; **Yij** = Overall observation

U = Overall mean

Ti = Treatment Effect

eij = error

Experimental design

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 feeding, washing of drinkers and replacing old water with fresh water. At the end of eight weeks, data were collected. Three birds were collected from each treatment (one bird from each replicate), starved over night, weighed early the following morning to obtain live weight and slaughtered. Bled weight was taken, and plucked weight was taken after defeathering. They were eviscerated and eviscerated weight was recorded. The weight of the organs - the heart,

proventriculus, filled and empty gizzard, large and small intestine, liver, lungs, pancreas, and spleen were all measured and recorded using sensitive scale (model and brand name of scale

Data collected was subjected to Analysis of Variance (ANOVA) in a Completely Randomized Design (CRD) and the significant means separated using Duncan's New Multiple Range Test. The result was expressed in plus-minus as mean of Standard Error of Mean. Carcass yield and organ weight were compared by between groups by one way ANOVA. SPSS Statistic Package (Version 22, Release 22.0.0.0. IBM)

	T4 (7.5%)	T1 (0.0%)	T3 (5%)	T2 (2.5%)
R1	T4R1	T1R1	T3R1	T2R1
R3	T4R3	T1R3	T3R3	T2R3
R2	T4R2	T1R2	T3R2	T2R2

3. Results and Discussion

Table 3: Mean carcass characteristics of chicken fed wood charcoal at different levels of inclusion.

Mean carcass weight for broiler chicken ± SEM				
Carcass Parts (g)	T1 (0%)	T2 (2.5%)	T3 (5%)	T4 (7.5%).
Live weight	1618.67^{a}±32.34	2161.00^{c}±5.51	1946.67^{b}±113.85	2021.33^{bc}±55.41
Bled Weight	1570.00^{a}±29.45	2064.00^{b}±26.67	1909.00^{b}±103.23	1961.13^{b}±36.41
Defeathered weight	1509.00^{a}±28.01	2002.67^{b}±16.58	1830.33^{b}±99.70	1902.00^{b}±12.29
Head	54.67^{a}±3.48	60.00^{a}±2.89	51.67^{a}±6.17	61.00^{a}±2.89
Shank	74.65^{a}±1.45	88.67^{a}±3.18	76.00^{a}±4.58	82.33^{a}±6.64
Wing	132.33^{a}±5.21	172.33^{b}±1.20	168.00^{b}±8.08	176.00^{b}±5.57
Thigh	195.00^{a}±2.89	260.00^{b}±2.20	243.00^{b}±23.86	224.00^{ab}±8.72
Drum stick	175.00^{a}±6.93	215.67^{b}±3.18	210.00^{b}±11.02	236.33^{b}±13.37
Breast	325.67^{a}±10.12	365.00^{a}±12.70	401.67^{b}±37.24	411.33^{b}±3.67
Neck	83.67^{a}±1.45	113.00^{b}±1.15	112.00^{b}±1.00	106.33^{b}±3.84
Back	204.67^{a}±1.45	329.00^{bc}±11.27	297.67^{b}±14.35	349.00^{c}±14.18

The result on carcass characteristics of broiler birds fed diets contain wood charcoal presented in table 3 above shows that there is positive significant differences ($p<0.05$) in all the parameters, that is the measured parameters were significantly affected ($p<0.05$) where the highest mean weight of live weight, bled weight, defeathered weight, shank, thigh and neck were found at T2 (2.5%). This is in accordance with the findings of Jiya *et al.* (20) who reported that the supplementation of activated coconut charcoal has significant effect ($p<0.05$) on carcass characteristics of broiler (Jiya et al., 2014). This could be attributed to increased feed intake and nutrient digestibility as was evident with improved conversion efficiencies in charcoal groups as was reported by authors sited above. This disagrees with the findings of (21) whose research work sates that broiler cut-up parts did not exhibit any major discernible response with the use of wood charcoal. This could be as a result of location, climate, different management practices and his supplementing some percentage of wood charcoal with vegetable oil.

The mean weight of bled weight, de-feathered weight, eviscerated weight, wing, thigh, drumstick and neck in T2 (2.5%), T3(5.0%) and T4 (7.5%) show no significant difference ($p<0.05$). This is in agreement with the findings of and and disagrees with the findings of whose research work states that broiler cup-up parts did not exhibit any major discernible response with the use of wood charcoal (Odunsi et al., 2007). It also agrees with the work of who observed that the addition of charcoal has no significant effect on carcass dressing percentage and the proportion of muscles in body weight (Majewska et al., 2011). In a previous study conducted by a similar trend was noted in broilers as a result of 0.3% charcoal supplementation (Majewska et al., 1999). This could be as a result of any nutritional factors such as phytate, saponin, and alkaloids found in charcoal.

Table 4: Mean organ weight characteristics of chicken fed wood charcoal at different levels of inclusion.

Mean organ weight for broiler chicken ± SEM				
Ogans (g)	T1 (0%)	T2 (2.5%)	T3 (5%)	T4 (7.5%).
Gizzard (filled)	46.67a±1.45	62.67c±2.03	48.67a±1.76	56.33a±1.76
Liver	34.00a±2.89	54.33b±0.33	35.67a±3.33	35.33a±0.88
Heart	8.00a±0.00	12.67b±0.33	11.33b±0.88	11.67b±0.88
Small Intestine	71.67ab±8.95	81.67b±2.60	63.67ab±0.88	54.00c±6.00
Large Intestine	41.67a±0.33	20.33b±0.33	12.33a±0.88	21.33b±1.86
Gizzard (empty)	30.33a±1.45	37.00b±1.16	36.33b±0.67	40.67c±0.88
Lungs	8.33a±0.33	15.67b±0.88	9.35a±0.33	9.00a±0.58
Pancreas	4.67a±0.33	6.00a±0.58	6.00a±1.00	5.00a±0.58
Proventriculus	9.00a±0.58	15.67b±1.86	11.00a±0.58	7.67a±0.88
Spleen	1.67a±0.17	2.00a±0.00	2.00a±0.00	1.83a±0.17

The organ weight of broilers shows that there is significant difference ($p<0.05$) among the treatment groups. Table 4 revealed that the highest mean of Gizzard, Lover, Heart, Lungs, Pancreas and spleen found was found at T2 (2.5%). This is compatible with the findings of who reported that there was significant difference ($p<0.05$) in the weights if gizzard, heart and spleen among the different levels if charcoal inclusion used in his experiment (Jiya et al., 2014). The authors concluded that feeding activated charcoal could be the reason for the largeness of the gizzard. The report is not in line with the findings of who reported otherwise (Edrington et al., 1998). The mean weight of spleen and pancreas show no significant difference ($p<0.05$) among the different treatments. The mean weight of Gizzard, Liver, Heart and Lungs in T3 (5.0%) and T4 (7.5%) show no significant difference ($p<0.05$)

4. Conclusion and Applications

1. It can be concluded that addition of wood charcoal into the diets of broiler chicken had positive effect on the broiler carcass parameters and the organ weight. which was confirmed through statistical significance ($P<0.05$)

2. With regards to most of the carcass parameters and organ weight measured, T2 treatment with 2.5% wood charcoal added to broiler feed had the best result therefore, wood charcoal can be added to

broiler feed at 2.5% for both starter and finisher feeds to achieve a better performance.

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