

Evaluation of General Performance and Carcass Qualities of Organically Raised Broiler Chickens from Day Old to 12 Weeks of Age

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Abstract – The effects of inclusion of organic feed in broiler chickens diet were investigated. One hundred and eighty day – old Ross broiler chicks were used in the study. In the 12-weeks feeding experiment, the birds were assigned to four treatments of Control- Conventional feed, X- Organic feed with the exclusion of millet, Y- Organic feed with exclusion of sorghum, Z- Organic feed with exclusion of wheat. Each treatment had 3 replicates of 15 birds per replicate in a randomized complete block design. Data were collated for growth performance and carcass quality of the broilers. The results indicated that feeding of broilers with conventional feed and organic feed had significant ($P < 0.05$) effect on feed intake, daily weight gain, feed conversion ratio and carcass yield. Feed intake, daily weight and feed gain ratio were highest for broilers on conventional feed. Live weight was also better for control diet while defeathered and dressing were favoured for broilers on diet X. Primal cuts, visceral organs and organoleptic properties were highest for control diet, followed closely for organoleptic properties was broilers on diet X. The study concluded that not much improvement were detected from organically raised broiler chickens except for visceral organs compared with conventional fed broilers but little improvement was observed on broilers on diet X.

Keywords – Broiler Chickens, Carcass Quality, Growth Performance and Organic Feed.

I. INTRODUCTION

In the developing nations of the world, human population is on a geometrical increase. So, efforts are being made on daily basis to increase food production and guard against starvation, as most people in the developing countries live below poverty level. In Nigeria, efforts are being made to increase food production especially in terms of carbohydrate and protein supplying foods. However, the average daily protein intake of Nigeria is very low, particularly, the animal protein. According to FAO (1989), man needs about 56g of protein daily in which 35g must be of animal origin. This is unachievable in Nigeria because the livestock industry is on a small-scale basis, and in order to meet this requirement, effort must be made to improve the livestock industry.

Poultry animals, like other animals require energy, vitamins and other nutrients for optimal growth and performance. One of the main set back experienced however in poultry production in Nigeria is the insufficient agricultural products used as feeding stuffs.

The decline in animal protein has been attributed to the scarcity and high cost of feed which accounts for over 70% of the total cost of production (Adenosu and Eshiett, 1989). For example, universal feed ingredient which is maize has high price due to the fact that it is being competed for by man for food and many production industries (Say, 1989).

Considerable controversy still remains on the use of antimicrobials to promote growth in food animal production. Epidemiological events that result in antimicrobial resistance by bacteria are difficult events to study, and several factors, including the overuse or misuse of antimicrobials in human and veterinary medicine, may intensify the severity of the problem (Shea, 2004). Interestingly, a recent economic analysis based on a large data set available in the United States suggested that production costs may not increase if growth promoters are not included in the feed (Graham *et al.*, 2007). In recent years, growth promoters have been banned in some European countries and have undergone voluntary withdrawal by some producers to attend to specific market demands. There has been an increase in investigations of alternatives to growth promoters, including plant extracts and organic acids. A frequent difficulty in accepting plant extracts as feed additives is the identification and standardization of their active substances. The modes of action of herbal extracts available on the market are not well understood. Limitations are more apparent for compounds that are mixtures of several extracts, each with a different claimed activity. However, active compounds obtained from plants have been used for a variety of human needs for centuries.

Because of their antimicrobial properties, organically feeds are also viewed as alternatives to growth promoters. Their supplementation in broiler feeds, however, has shown good results, in part because of the different organic acids, doses, microbial challenges, or evaluated responses that have been used in the published experiments (Adedeji, 2013; Adedeji *et al.*, 2014a; Fanatico *et al.*, 2007, 2006, 2005; Castellini *et al.*, 2002, 2002c; Gordon and Charles, 2002; Pattern *et al.*, 1988).

Our experiment was aimed at determining the general performance and carcass evaluation of broilers fed conventional feed meal and all-vegetable diets supplemented with organic wheat, sorghum and millet. Body weight, feed intake, feed conversion, and the

evaluation of carcass traits were measured in experimental broiler chickens raised to 56 d.

II. MATERIALS AND METHODS

A. Site of Experiment

The experiment was carried out at the Poultry unit of Teaching and Research Farm Ladoke Akintola University of Technology, Ogbomoso, Oyo State, Nigeria. Ogbomoso is a derived Savanna Zone of Nigeria that lie within the latitude 8° 15' North and longitude 4° 15' East. The area has a annual rainfall of 1247mm with altitude between 300-600 meter above the sea level while the mean annual temperature is about 27°C (Amao *et al.*, 2011).

B. Collection and preparation of test ingredients

The organic test ingredients such as soyabeans, maize and local fish (dried catfish) were sourced for at Ogbomoso, Oyo state while sorghum, wheat and millet were sourced for in Mokwa, Niger state, north central of Nigeria. Conventional feeds were purchased at a reputable feed mill in Ogbomoso.

Feed ingredients for organic diet were processed in various ways as to reduce the anti-nutritional factors to the barest minimum. For example, soybean was toasted and test ingredients were milled and mixed in a local milling house (where household foodstuff are milled) to prevent contamination or mixing with conventional foods.

Vegetable such as *Amaranthus esculentus*, (succulent Amaranths), *Talinum triangulae* (water leaf), *Celosia esculentus*_(green) were given to birds as sources of vitamins and minerals.

C. Experimental diets

Four experimental diets were formulated. Diet 1 was the control with the conventional feed while diets X, Y, Z are organic feed with exclusion of millet, sorghum and wheat respectively. The percentage composition of experimental diets for both starter and finisher phase are shown in tables I and II and the proximate analyses of experimental diets (table III) were determined by the AOAC (1990) method. Bomb calorimeter was used to determine the gross energy (G.E) value of experimental diets. Metabolizable energy (ME) was calculated with the formula: $ME (kcal/Kg) = 37 \times \%CP + 81 \times \%fat + 35.5 \times \%NFE$

D. Experimental birds and their management

A total number of 180- day old Ross strain of broiler chicks purchased from Ajanla farm km16, Lagos-Ibadan express ways, Oyo State, was used for this experiment. They were divided into four treatments and three replicates of fifteen birds each to make a total of forty five broiler chicks per treatment in a completely randomized design. The chicks were raised on deep litter but the treatment groups were allowed a period of three hours on the experiment range quadrants beside the poultry house when they were two weeks old and the pen contained young succulent vegetables which includes *Celosia* spp (green), *Talinum triangulare* (waterleaf) and *Amaranthus esculentus* (amaranth). Before the arrival of the chicks, the poultry house was scrubbed thoroughly with hot water and a solution of water and Neem tree extract (*Azardiracta indica*) was used to sprinkle the house as fumigant and

insecticide. Also, feeding troughs and drinkers were thoroughly washed with water and neem tree extract and later sundried.

On arrival of the birds, the control groups were administered water and glucose, while the treatment groups were given only water. The birds were provided feed and water *ad libitum*. All necessary vaccines and medications were given to the control birds according to the prevailing standard in the area while organic birds were daily administered extracts of neem tree and garlic. On occasions when there is morbidity, the sick birds were isolated and treated with conventional medications and they were not returned to the flock. Litter materials were changed on weekly basis and the experiment lasted 12 weeks.

E. Data collection

Data were obtained for feed intake, on a daily basis, weekly weight gain of the birds and feed to gain ratio (General performance); Carcass traits were evaluated at end of 56d from a total number of randomly selected 108 broiler chickens comprises of 27 birds per treatment tagged and starved overnight before taken to the laboratory for further analysis. Broilers were weighed, stunned by cervical dislocation and bled after cutting off the jugular veins. The birds were scalded and then eviscerated to remove the internal organs (heart, lungs, liver, kidney, gastro-intestinal tract, and gizzard) as well as the cut parts (head, neck, wings, breast, back, drumstick, shank) for measurement. The dressed carcass as well as the internal organs were weighed and expressed as percentage live weight. Organoleptic properties was also evaluated, Sample for palatability were obtained from the breast, thigh and wings of the birds. Meat preparation was done using a wet cooking method. The samples were wrapped in impervious polythene pouches which could be destroyed by cooking process. In the process. The meat samples were cooked in boiling water for 20 minutes using water bath and no spices was added to the meat. The meat was then served to 10member panels comprising mainly of students and staffs of Ladoke Akintola University of Technology Ogbomosho. The trained panelists evaluated the samples for color flavor, juiciness, tenderness and general acceptability, the assessment was based on 9 point hedonic scale. The score was arranged in a descending order, the maximum score was given to extremely like condition while the lowest score 1 was for the poorest condition.

F. Statistical analysis

All data collected were subjected to one way analysis of variance (ANOVA) using the procedure of SAS (2000) and where significant differences were indicated, Duncan multiple range test was used to separate the means.

III. RESULTS AND DISCUSSION

Table IV shows the performance characteristics of broilers fed organic feeds and vegetables at 12weeks. Statistical analysis showed that there was a significant difference ($P < 0.05$) in the total feed intake of birds at 12weeks, birds on control diet which were fed with

conventional feed had the highest value of 8.44g/bird/day compared to organic groups. So also were significant differences ($P<0.05$) in the total weight gain as birds on control diet had the highest value of 35.24g/bird/day while birds on treatment X and Z were however statistically similar. Birds on treatment X showed the highest significant ($P<0.05$) value in the feed to gain ratio than other birds. This present study was similar to the observation of Castellini *et al.*, (2002a) on performance and behaviour of chickens with different growing rate reared according to the organic system.

Significant differences ($P<0.05$) were observed in the live weight(g) of birds at 12weeks from the table V shown, control group with value of 2300.00g was the highest while birds in treatment X,Y,Z were statistically similar. The defeathered weight (%) of birds in treatment X showed a significant difference ($P<0.05$) with the value 91.63% while treatments X, Y, Z showed significant differences ($P<0.05$) compared to control unit as observed in the dressed weight of birds. This present observation was in accordance to the report of Hernandez *et al.*, (2004) for broilers under the Influence of two plant extracts.

Primal cuts characteristics as observed in table VI, the parameter measures for breast, thigh, drumstick, wing, and back showed a significant difference ($P <0.05$) with the highest values in control. The result for head showed significant differences ($P<0.05$) as observed in treatments X and Z with the highest values of 3.68g and 3.73g respectively, followed closely treatment Y while control showed the lowest value of 2.83g. The result of carcass characteristics for the organic broilers showed significant ($P<0.05$) differences at 12 weeks, it was observed that the control birds had the highest live weights but the organic birds performed better in dressing percentage, this contradicts the claims of (Pietrzak *et al.*, 2003) which states that test ingredients does not have significant negative metabolic reactions or disorders that affects the muscle, growth, lipogenesis/ lipolysis or osteoblastic activity.

The organ characteristic of experimental birds is presented in the table VII. The liver weight, kidney weight, heart weight, lung weight, and GIT weight of treatments Y were significantly ($P<0.05$) affected by dietary treatment, however, the whole gizzard weight of birds on treatment X were significantly ($P<0.05$) different while treatments Y and Z were statistically similar. There was no significant difference ($P>0.05$) in empty gizzard weight of experimental birds at week 12. The pattern of values obtained in this present study was in line with the report documented by Muriel and Pascual, (1995) for chickens reared on free-range.

The results of organoleptic properties of broilers fed organic diets are shown in the table VIII. The colour of the birds in control (birds fed conventional feed) was extremely acceptable, treatments X, Y and Z were moderately acceptable. The flavor of birds in control group was very desirable, treatment X was extremely desirable, treatment Y and Z were moderately desirable. The juiciness of birds in control group was very juicy,

treatment X and Y were moderately dry, treatment Z was slightly juicy. The tenderness of birds in the control group, treatment X, Y, Z were slightly loose, general acceptability of birds in the control group, treatment X, Y,Z were all moderately like. The water holding capacity of group X was the highest so also was cooking loss in group Z. However, there was an increase in the feed to gain ratio of group Z birds at 12weeks and the organ weights of organic birds was higher than the conventional birds and results showed that group Y birds which had a sorghum exclusive diets had the highest in parameters for organ weights, this contradicts the claims of Fashina *et al.*, (2004) which says diets with high fibre content always result in heavy organ weight. The water holding capacity and the cooking loss were higher in organic birds.

VI. CONCLUSION AND RECOMMENDATION

The study was conducted to access the effect of organic feeds and vegetables on organic broilers at 12weeks. The result of the study shows that organically raised birds did not improve in terms of performance. Control birds performed better than organic birds in growth performance, carcass characteristics and primal cuts. Antibiotics support better performance and higher carcass yield. The study showed the need for a better performance and improvement on feed, health and welfare of broiler chicken. It is recommended that pure organic poultry should not be practiced on a large scale; instead it should be done along with conventional because it can lead to loss in this part of the country. Further studies can be conducted to determine the actual requirement of this strain of broilers.

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Table I: Composition of Experimental Diets (Broiler Starter Mash)

Ingredients	Control Group	Group X	Group Y	Group Z
Conventional maize	48.07	-	-	-
Organic wheat	-	14.01	14.99	-
Organic sorghum	-	14.01	-	13.99
Organic millet	-	-	14.99	13.99
Wheat offal	7.5	7.5	7.5	7.5
Full fat SBM	-	43.02	43.08	43.08
Commercial SBM	40.30	-	-	-
local fishmeal	-	2.50	2.50	2.50
palm oil	-	2.0	2.0	2.0
oyster shell	1.2	2.7	2.7	2.7
bonemeal	2.0	-	-	-
vit/min premix	0.25	-	-	-
methionione	0.18	-	-	-
lysine	0.25	-	-	-
Salt	0.25	0.25	0.25	0.25
Total	100	100	100	100
Calculated Analysis				
ME kcal/kg	2872.67	3002.45	3019.00	3067.6
CP (%)	23.04	27.24	26.74	24.67
Crude fiber	3.75	3.90	4.01	4.00
Fat %	3.59	5.03	4.91	4.90

Control= Conventional feed, X= Organic feed minus millet Y= Organic feed minus sorghum, Z= Organic feed minus wheat

TABLE II: Composition of experimental diets (broiler finisher mash)

Ingredients	Control	Group X	Group Y	Group Z
Conventional maize	45.00	-	-	-
Organic wheat	-	14.01	14.99	-
Organic sorghum	-	14.01	-	13.99
Organic millet	-	-	14.99	13.99
Wheat offal	10.00	7.5	7.5	7.5
Full fat SBM	-	43.02	40.08	43.08
Commercial SBM	18.25	-	-	-
Palm kernel cake	23.00	-	-	-
local fishmeal	-	2.50	2.50	2.50
palm oil	-	2.0	2.0	2.0
oyster shell	1.2	2.7	2.7	2.7
bonemeal	1.50	-	-	-
vit/min premix	0.25	-	-	-
methionione	0.25	-	-	-

lysine	0.25	-	-	-
Salt	0.30	0.25	0.25	0.25
Total	100	100	100	100
Calculated Analysis				
ME kcal/kg	2712.67	3002.45	3019.00	3067.6
CP (%)	17.39	27.24	26.74	24.67
Crude fiber	5.16	3.90	4.01	4.00
Fat %	4.04	5.03	4.91	4.90

Control= Conventional feed, X= Organic feed minus millet Y= Organic feed minus sorghum, Z= Organic feed minus wheat

Table III: Proximate composition of experimental diets at finishers phase

Parameters (%)	Control	X	Y	Z
Crude protein	10.50	8.75	7.26	7.08
Crude fibre	9.80	6.02	4.11	8.23
Ether extracts	22.08	21.45	20.65	20.71
Ash	9.45	11.35	9.58	8.05

Control= Conventional feed, X= Organic feed minus millet Y= Organic feed minus sorghum, Z= Organic feed minus wheat

Table IV: Performance characteristics of broilers fed organic feeds and vegetables at 12weeks

Parameter (g/bird/day)	Control	X	Y	Z	SEM
TOT. FEED INTAKE	86.44 ^a	30.13 ^b	24.51 ^c	17.25 ^d	2.01
TOTAL WEIGHT GAIN	35.24 ^a	10.94 ^c	12.07 ^b	10.50 ^c	0.21
FEED: GAIN RATIO	2.45 ^b	2.75 ^a	2.03 ^c	1.64 ^d	0.08

^{abc} Mean with different superscript on the same row are significantly different (p<0.05)

Control= Conventional feed, X= Organic feed minus millet Y= Organic feed minus sorghum, Z= Organic feed minus wheat

Table V: Carcass characteristics of broilers fed organic feeds and vegetables at 12 weeks

Parameters	Control	X	Y	Z	SEM
LIVE WEIGHT(g)	2300.00 ^a	840.00 ^b	955.00 ^b	825.00 ^b	131.77
DEFEATHERED(%)	83.84 ^{ab}	91.63 ^a	76.96 ^b	84.06 ^{ab}	1.61
DRESSING (%)	41.93 ^b	45.72 ^a	45.07 ^a	46.36 ^a	2.16

^{abc} Mean with different superscript on the same row are significantly different (p<0.05)

Control= Conventional feed, X= Organic feed minus millet Y= Organic feed minus sorghum, Z= Organic feed minus wheat

Table VI: Primal cuts of broilers fed organic feed and vegetables.

Parameters	Control	X	Y	Z	SEM
BREAST	18.24 ^a	12.66 ^b	12.18 ^b	11.50 ^b	0.64
THIGH	9.76 ^a	7.65 ^c	8.38 ^b	7.14 ^c	0.22
DRUMSTICK	10.44 ^a	7.65 ^{bc}	6.86 ^c	8.31 ^b	0.31
WING	8.26 ^a	7.14 ^b	6.70 ^b	7.26 ^b	0.18
BACK	15.87 ^a	10.61 ^c	10.66 ^c	12.03 ^b	0.48
HEAD	2.83 ^b	3.68 ^a	3.20 ^{ab}	3.73 ^a	0.12

^{abc} Mean with different superscript on the same row are significantly different (p<0.05)

Control= Conventional feed, X= Organic feed minus millet, Y= Organic feed minus sorghum, Z= Organic feed minus wheat

Table VII: Organ weights of broilers fed organic feeds and vegetables.

Parameters	Control	X	Y	Z	SEM
LIVER	2.16 ^c	2.96 ^b	3.66 ^a	3.01 ^b	0.12
KIDNEY	0.64 ^b	0.82 ^a	0.95 ^a	0.41 ^c	0.05
HEART	0.05 ^c	0.42 ^b	0.53 ^a	0.43 ^b	0.03
LUNG	0.54 ^{ab}	0.57 ^{ab}	0.62 ^a	0.48 ^b	0.02
WHOLE GIZZARD	3.47 ^b	4.19 ^a	3.66 ^b	3.73 ^b	0.09

EMPTY GIZZARD	2.16	2.45	2.13	2.49	0.08
GIT	6.93 ^c	10.31 ^b	14.08 ^a	13.65 ^a	0.80

^{abc} Mean with different superscript on the same row are significantly different (p<0.05)

Control= Conventional feed, X= Organic feed minus millet, Y= Organic feed minus sorghum, Z= Organic feed minus wheat

Table VIII: Organoleptic properties of broilers fed organic feed and vegetables.

Parameters	Control	X	Y	Z
COLOUR	8.75	7.00	7.00	6.50
FLAVOUR	8.25	8.50	7.25	7.00
JUICENESS	7.50	7.00	7.00	6.00
TENDERNESS	6.00	6.25	5.50	5.75
GEN.ACCEPTABILITY	6.75	6.75	7.25	6.75
COOKING LOSS	35.15	30.50	33.68	37.50
WHC	64.50	69.50	66.32	62.50

Control= Conventional feed, X= Organic feed minus millet, Y= Organic feed minus sorghum, Z= Organic feed minus wheat, GEN. = General, WHC = Water holding capacity