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Research Article

Effect of Guinea Corn Based-Diets Supplemented with Feed Grade Enzymes on Productivity of Broiler Chickens

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Abstract

One hundred and fifty (150) day old unsexed Anak broiler chicks were used in a 56 day feeding trial to evaluate the effect of guinea corn based diets supplemented with enzymes on the growth performance and internal organs of broiler chickens. The birds were assigned to five dietary treatments (T1 - T5) containing 100% maize and 0% guinea corn, 75% maize and 25% guinea corn, 50% maize and 50% guinea corn, 25% maize and 75% guinea corn, and 0% maize and 100% guinea respectively. Apart from the control diet, all the diets contained 0.5% Maxigrain® a commercial feed grade enzyme product containing cellulase, glucanase, xylanase and phytase. Each treatment was replicated three times with 10 birds per replicate with a total of 30 birds per treatment in a completely randomized design (CRD). Feed and water were given *ad libitum* for 8 weeks. Results showed that at the starter phase diets had no significant ($P > 0.05$) effect on live weight, feed intake and feed: gain ratio. During the finisher phase, replacement of maize with guinea corn up to 100% compared favourably with maize on live weight, feed intake and feed: gain ratio. Guinea corn did not show negative effect on kidney, liver, spleen, heart and pancreas. In conclusion, guinea corn could replace maize in the diets supplemented with cellulase, glucanase, xylanase and phytase for broiler chickens.

Keywords: *Enzymes; Growth Performance; Guinea Corn; Internal Organs; Maize*

Introduction

The poultry industry has suffered more than any other livestock industry as a result of inadequate supply and high cost of feed [1,2] and feed cost is expected to continue in the upward swing [3]. They are various sources of energy in poultry diets in the tropics but maize has remained the chief energy source in compounded diets and constitutes about 50% of poultry ration [4,5]. Pressure on maize, wheat and recently cassava has been on the increase worldwide with emphasis being placed on export and other diversified use mostly in flour based foods and ethanol production as an alternative source of fuel [6]. According to Etuk [2] of energy feedstuff for poultry maize is most competed for. Research efforts are now geared towards evaluating alterative feed ingredients for poultry especially energy and protein.

According to [7], such alternatives should have comparative nutritive value but cheaper than the conventional protein and energy sources such as guinea corn (sorghum). Worldwide, guinea corn grain is a very important ingredient in broiler diets. It has over 90% of the feeding value of maize [8]. Studies by Kumar., *et al*. [9] revealed that feeding reconstituted red sorghum-based diet with a tannin con-

tent of 16 g/kg to broiler chicken did not exert any appreciable influence on nutrient utilization, blood biochemical enzymes and gross pathological changes even at 100% replacement of maize.

Objective of the Study

The objective of this study was to determine the effect of guinea corn based-diet supplemented with enzymes on finisher broiler chicks.

Materials and Methods

Site of the experiment

The experiment was conducted at the poultry unit of Teaching and Research Farm of the University of Uyo, Uyo, Nigeria. Uyo is located on Latitude 4^0 57'N and longitude 7^0 53'E with average annual rainfall of 2,190 mm. The average relative humidity during the experimental period was 81%.

Experimental design

The experiment was carried out on completely randomized design (CRD). One hundred and fifty (150) day-old unsexed broiler chicks of Anak strain were used. There were five dietary treatments (T1, T2, T3, T4 and T5) each having 30 birds. Each treatment was replicated three times and each replicate had 10 birds. Starter and finisher diets (Table 1 and 2) were formulated for each of the treatments. T1 was the control diet without guinea corn. T2 contained 75% maize and 25% guinea corn, T3 contained 50% maize and 50% guinea corn, T4 contained 25% maize and 75% guinea corn and T5 contained 0% maize and 100% guinea corn. Apart from the control diet, all the diets contained 0.5% Maxigrain® a commercial feed grade enzyme product containing cellulase, glucanase, xylanase and phytase.

Ingredients (%)	T1 0% GC	T2 25% GC+ENZ	T3 50% GC+ENZ	T4 75% GC+ENZ	T5 100% GC +ENZ
Maize	51.0	38.25	25.50	12.75	-
Guinea corn	-	12.75	25.50	38.25	51.00
Soya bean meal	30.00	30.00	30.00	30.00	30.00
Palm kernel cake	11.30	11.30	11.30	11.30	11.30
Fish meal	4.00	4.00	4.00	4.00	4.00
Bone meal	3.00	3.00	3.00	3.00	3.00
Salt	0.25	0.25	0.25	0.25	0.25
Lysine	0.20	0.10	0.10	0.10	0.10
Methionine	0.10	0.10	0.10	0.10	0.10
Premix*	0.25	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00	100.00
Calculated nutrient content (%)					
Crude protein	23.00	23.00	23.00	23.00	23.00
Ether extract	3.57	3.57	3.57	3.57	3.57
Crude fibre	4.16	4.23	4.31	4.39	4.65
Energy Kcal/ME/kg	2836	2835	2834	2832	2830

Table 1: *Ingredient and nutrient composition of starter diets.*

**Premix supplied per kg starter diet: Vitamin A 15,00 I.U, Vitamin D3 13000 I.U, thiamine 2 mg, riboflavin 6 mg, pyridoxine 4 mg, Niacin 40 mg, cobalamin 0.05g, biotin 0.08 mg, choline chloride 0.05g, manganese 0.096g, Zinc, 0.06g Iron 0.024g, copper 0.006g, iodine 0.01 kg, selenium 0.24 mg, cobalt 0.024 mg and antioxidant 0.125g. GC = Guinea Corn, ENZ = Enzyme.*

Ingredients (%)	T1 0% GC	T2 25% GC+ENZ	T3 50% GC+ENZ	T4 75% GC+ENZ	T5 100% GC +ENZ
Maize	51.0	38.25	25.50	12.75	-
Guinea corn	-	12.75	25.50	38.25	51.00
Soya bean meal	28.00	28.00	28.00	28.00	28.00
Palm kernel cake	15.15	15.15	15.15	15.15	15.15
Fish meal	2.00	2.00	2.00	2.00	2.00
Bone meal	3.00	3.00	3.00	3.00	3.00
Salt	0.25	0.25	0.25	0.25	0.25
Lysine	0.10	0.10	0.10	0.10	0.10
Methionine	0.25	0.25	0.25	0.25	0.25
Premix*	0.25	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00	100.00
Calculated nutrient content (%)					
Crude protein	20.00	20.05	20.10	20.15	20.20
Ether extract	4.88	4.88	4.88	4.88	4.88
Crude fibre	5.15	5.25	5.35	5.34	5.56
Energy Kcal/ME/kg	2836	2835	2834	2833	2832

Table 2: *Ingredients and nutrients composition of finisher diets.*

**: 1 kg premix contained: vitamin A (10,000,000 iu), vitamin D3 (1,000,000 iu), vitamin E (16,000 mg), vitamin k3 (800 mg), vitamins B2 (22,00 mg), niacin (22,00 mg), vitamin B12 (10 mg), Folic Acid (400mg) Biotin (32mg), Chlorine chloride (200,00 mg), Zinc (32,000 mg) iodine (600 mg), cobalt (12 mg), selenium (40 mg), antioxidant (48,000 mg). GC = Guinea Corn, ENZ = Enzyme.*

Management of experimental birds

The birds on arrival to the farm were weighed using a sensitive weighing balance to obtain the initial weight. The birds were managed in deep litter pens during the brooding and rearing phases. Glucose solution and multivitamins supplements were given to the birds. Thereafter, they were allotted to the various treatments. Heat was provided using kerosene stoves. Starter feed was given from 1 - 4 weeks and finisher feed from 5 - 8weeks. The feeds and water were provided *ad libitum*. All necessary vaccinations against Newcastle and infections bursal (gumboro) diseases were carried out.

Data collection and statistical analysis

The daily feed intake was recorded and pooled at the end of the week and average daily feed intake was recorded. Weekly live body weight was measured and average daily live weight calculated. With the daily feed intake and daily live weight known, the feed: gain ratio was calculated.

At the end of the experiment, three birds of known weight from each treatment were killed, immersed in hot water (60^{0}C) for 30 seconds. The weights were made to be similar across treatments. Female birds were used to remove the effect of sex on organ weights. Thereafter, their feathers were plucked and their abdomen were opened, and their internal organs removed. Each internal organ was weighed and the weight expressed as percentage live body weight.

Data collected were subjected to Analysis of Variance (ANOVA) using SPSS software and significant means were separated using Duncan New Multiple Range Test [10] as described by [11].

Results and Discussion

Growth performance

The effect of guinea-corn based diet supplemented with enzymes on growth performance of starter broiler chicks is shown in table 3. At that phase of production diets had no significant effect ($P > 0.05$) on all the growth parameters measured. Addition of guinea-corn up to 100% in the diet did not have negative effect on the growth indices. The non-significant effect of diets on growth

Treatments	T_1	T_2	T_3	T_4	T_5	SEM
Parameters	T_1 0% GC +ENZ	T_2 25% GC+ENZ	T_3 50% GC+ENZ	T_4 75% GC+ENZ	T_5 100% GC +ENZ	
Initial live weight (g)	34.00	35.00	35.00	35.00	35.00	4.07
Final live weight (g)	696.00	688.00	689.00	688.00	682.00	25.05
Daily gain (g)	23.29	22.96	23.0	23.29	22.75	3.13
Total feed intake (g)	926.00	925.00	924.00	915.00	946.00	0.62
Daily feed intake (g)	33.07	33.37	33.00	32.34	33.86	0.04
Feed conversion ratio	1.29	1.45	1.43	1.39	1.49	0.22
Mortality	0.00	0.00	0.00	0.00	0.00	-

Table 3*: Effect of guinea corn based diet supplemented with enzymes on growth performance of starter broiler chicks. abc: Means along the same row with different superscripts are significantly (P0.05) different. SEM: Standard Error of Means. GC = Guinea Corn, ENZ = Enzyme.*

performance even when guinea-corn replaced maize up to 100% level is an indication of feeding value of guinea corn and the efficacy of the feed grade enzymes. The result was in line with findings of [8] who reported that guinea corn has over 90% of the feeding value of maize. Worldwide, guinea corn is a very important ingredient in broiler diets. In terms of the nutritive value, cost and availability, guinea corn is the next alternative to maize in poultry feeds [12]. Also [13] observed no depressive effect on growth and feed efficiency when guinea corn replaced maize even at 100% in meat chickens. In contrast, [14] reported adverse effect on growth performance. To cushion this enzyme supplementation have been advocated [2,6,15].

The dietary effects of guinea-corn based diet on finisher broilers is presented in Table 4. Diets significantly (P<0.05) influenced all the growth parameters except total feed intake and daily feed intake. Final live weight and daily weight gain which followed similar trend were significantly (P<0.05) influenced by diets. Replacement of maize with guinea corn at 50% reduced both final and daily weight gain which was followed by 75%. Inclusion of guinea corn did not alter both total feed intake and daily feed intake. As expected, birds that consumed diet with 50% guinea corn had poor feed: gain ratio. This was followed by 75%.

Parameters	T_1 0% GC +ENZ	T_2 25% GC+ENZ	T_3 50% GC+ENZ	T_4 75% GC+ENZ	T_5 100% GC +ENZ	SEM
Initial live weight (g)	696.00	688.00	689.00	688.00	682.00	54.07
Final live weight (g)	2160.00^a	2146.67^a	1887.40^c	2009.70^b	2193.33^a	77.14
Daily gain (g)	52.28^a	52.11^a	42.86^c	47.18^b	53.96^a	2.74
Total feed intake (g)	4135.00	4109.00	4117.33	4035.33	4195.67	97.04
Daily feed intake (g)	147.68	146.75	147.05	144.12	149.87	3.46
Feed: gain ratio	2.82^c	2.82^c	3.43^a	3.05^b	2.78^c	0.25
Mortality	0.00	0.00	0.00	0.00	0.00	-

Table 4: *Effect of guinea corn based diet supplemented with enzymes on growth performance of finisher broiler chickens. abc: Means along the same row with different superscripts are significantly (P0.05) different. SEM: Standard Error of Means. GC = Guinea Corn, ENZ = Enzyme.*

The poor live weight observed in birds that were fed 50 and 75% guinea corn could be as a result of poor nutrient utilization. This could not be unconnected with their feed: gain ratio which was also poor. The above findings agreed with previous reports that maize could completely be substituted with guinea corn without any adverse effects on performance [16-18]. In economic respect, [6] and [15] found that guinea corn could completely substitute maize in broiler diet with no obvious deterioration of economic efficiency. Several authors have reported that guinea corn (sorghum) maintains good nutritional value to be competed with maize in broiler diets for good growth [19-22].

Internal organs

The effect of guinea corn on internal organs of broiler chickens is indicated in table 5. The dietary treatments did not have significant (P > 0.05) effects on kidney, spleen and heart, indicating that guinea corn is safe and was not detrimental to these important organs. In layers, non-impairment of these organs by guinea corn could be attributed to good laying performance of birds feed guinea corn based diets [23]. However, significant differences were recorded on gizzard, liver, small intestine and large intestine.

Treatments Parameters	T_1 0% GC+ENZ	T_2 25% GC+ENZ	T_3 50% GC+ENZ	T_4 75% GC+ENZ	T_5 100% GC+ENZ	SEM
Kidney	0.39	0.37	0.33	0.31	0.34	0.03
Spleen	0.15	0.13	0.10	0.18	0.12	0.25
Gizzard	3.15^a	0.88^b	3.89^a	2.70^a	2.69^a	0.32
Heart	0.40	0.34	0.41	0.36	0.49	0.05
Liver	2.49^a	2.11^b	2.10^b	1.96^b	2.09^b	0.13
Small intestine	0.16^d	0.34^c	0.88^a	0.56^b	0.16^d	0.12
Large intestine	3.79^c	3.23^c	6.15^a	4.42^b	5.84^a	0.95

Table 5: *Effect of guinea-corn based diet on internal organs of broiler chickens.*
abc: Means along the same row with different superscripts are significantly (P0.05) different.
SEM: Standard Error of Means. GC = Guinea Corn, ENZ = Enzyme.

The smallest gizzard wad recorded by inclusion of 25% guinea corn. The weight of the gizzard of other guinea corn inclusion levels were the same as control. This suggests that breaking of feed in the gizzard for proper digestion in the duodenum would not be impaired. The liver of the control group was bigger than the livers of all the groups that consumed guinea corn. This indicates that guinea corn consumption by the birds did not impact negatively to enlarge the liver. The small intestine was larger in 50% guinea corn and smallest in control and 100% guinea corn. In contrast the large intestine was bigger in 50 and 100%, but smaller in control and 25% guinea corn.

Conclusion

Feeding of 100% guinea corn based diet did not adversely affect feed intake and live weight of the broiler chickens. Furthermore, the internal organs of the birds were not also negatively affected. Therefore, replacement of maize by guinea-corn by 100% in diet of broiler chickens supplemented with cellulae, glucanase, xylanase and phytase is recommended for optimum broiler performance.

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