BAP -14

Efficacy of Phytase® Enzyme on the Growth and Carcass Characteristics of Broilers Fed *Digitaria Iburua*-Based Diet

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Abstract
This study evaluated the effect of phytase® supplementation on the growth and carcass characteristics of broiler chickens fed *Digitaria iburua* (acha) diet. Two basal diets were formulated; maize-soybean and acha-soybean to serve as positive (T1) and negative (T2) control, respectively. The phytase® enzyme (PHY) was supplemented into the acha diet at 250, 500 and 750mg/kg to constitute treatments 3, 4 and 5, respectively. 120, day-old Arbor-Acre broiler chicks were assigned to the five treatments with 24 birds (3 replicates of 8 birds each) and studied for 49 days under the deep litter system. Data were collected on the body weight, weight gain, feed intake, feed conversion ratio and mortality rate as well as carcass yield, prime cuts and organ weights. Significant ($p<0.05$) differences were observed in all growth parameters between dietary treatments. Final body weight, weight gains, feed intake and FCR improved with enzyme supplementation. Cost per kg gain and cost of feed consumed per bird were significantly ($p<0.05$) influenced by dietary treatments. PHY supplementation slightly improved the carcass yield (75.21 – 75.85%) of broilers. Apart from back and breast weight, other prime cuts showed no differences ($p>0.05$) between treatments. Relative organ weights (full gizzard, empty gizzard, proventriculus and oesophagus) were influenced ($p<0.05$) by dietary treatments. This study concludes that PHY supplementation into acha–based diet improved the growth performance of broiler chickens and optimum performance is achieved at 500mg PHY/kg of feed.

Keywords: Acha, Phytase®enzyme, growth rate, groilers

Introduction

Cereals and legumes form a significant portion of the food supply for humans and other animals, as they are a major source of carbohydrates, proteins, lipids and minerals (Katina *et al.,* 2005). In the tropics, maize is the most utilized cereals used in the animal feed industry and its future utilization is hampered by its growing global demand for industrial uses, consequently the exorbitant cost of finished animal feed products (Ukim *et al*., 2013). Therefore, current research focuses on the exploration oflocally available, cheaper alternative feed resources that can replace the expensive conventional cereals (Ukim *et al*., 2012). One of such alternative feedstuffs is Acha.

Acha commonly called "black fonio" or "hungry man rice" is an indigenous cereal of West Africa (Dachi *et al*., 2014). Acha grain is reported to have comparable nutrients to other grains with crude protein content of up to 12% and gross energy of 3556.06 - 3786.4kcal/kg (Dachi *et al*., 2014).Several studies on have shown positive effects of phytase supplementations on broilers fed corn (Olukosi *et al*.,2010). However there is dearth of information on the use of phytase in improving acha utilization by broilers.

This study thus evaluates the efficacy of phytase supplementation on the growth and carcass characteristics of broiler fed acha-based diets.

Materials and Methods

This study was conducted at the Poultry unit, University ofCalabar Teaching and Research Farm. Two basal diets were formulated (Table 1); maize-soybean and acha-soybean to serve as positive (T1) and negative (T2) control, respectively. To improve acha utilization, phytase® (PHY) enzyme was supplemented into the acha-based diet at 250, 500 and 750mg/kg to constitute treatments 3, 4 and 5, respectively. 120, day-old Abor-Acre broiler chicks were assigned to the five treatments with 24 birds each. Each treatment was further divided into three replicates of eight (8) birds per replicate. All chicks were managed in the deep litter system under the same experimental conditions for 49 days.Data were collected on the growth performance (body weight, weight gain, feed intake, feed conversion ratio and mortality rate) and carcass characteristics (carcass yield, prime cuts and organ weights).

Data were subjected to the one-way analysis of variance in a completely randomized design and where significant, means were separated using the Duncan multiple range test using the GENSTAT (GENSTAT, 2011) software package.

Table 1 Gross composition of basal diets (%)

Ingredient	Starter diets		Finisher diets	
	Maize-based	Acha-based	Maize-based	Acha-based
Maize	49.25	0.00	50.00	0.00
Acha	0.00	49.25	0.00	50.00
Soybean meal	35.00	35.00	28.75	28.75
Fish meal	2.00	2.00	2.00	2.00
Wheat offal	7.00	7.00	10.00	10.00
Bone meal	3.50	3.50	3.00	3.00
Salt	0.25	0.25	0.25	0.25
PKC	2.00	2.00	5.00	5.00
*Vit-Min Premix	0.25	0.25	0.25	0.25
Palm oil	0.50	0.50	0.50	0.50
Methionine	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00
Calculated values				
Crude Protein (%)	22.51	23.99	20.85	22.35
ME (Kcal/kg)	3100.40	3177.53	3041.75	3120.05

Premix provided: Vtamin A - 1,5000, 00IU, Vitamin D_3 - 300,000 IU, Vitamin E - 400mg, Vitamin K_3 – 100mg, Vitamin B_{12} – 2,000mcg, Nicontinamide – 2,000mg, Calcium D-Pantothenate – 800mg, Choline Chloride – 40,000mg, Ferrous Sulphate – 2,000mg, Manganese Sulfate – 5,000mg, Copper Sulfate – 80mg, Zinc Oxide – 3,000mg, Cobalt Sulfate – 10mg, Potassium Iodide – 120mg, Magnesium Sulfate – 1,000mg, DL- Methionine – 10,000mg, Antioxidant – 18,000mg

Results and Discussion

The result of the growth performance of broilers fed acha-based diet supplemented with phytase is presented in Table 2. Final body weight was significantly ($p<0.05$) influenced by dietary treatments. Birds fed 750 mg of phytase had significantly ($p<0.05$)higher final body weight comparable to those on 250 mg and 500 mg of phytase diets while those fed maize-based diet had the least value (1774.40g). values (1774.40 – 2141.67g) obtained were lower than 2155g earlier reported by Dafwang (2006) but are within the range(1557.50 – 2212.50g and 1764 – 2820.37g) reported by Omojola *et al*. (2014) and Afolayan *et al*. (2014), respectively for 8-week old broilers. Birds fed 250 mg of phytase consumed the highest feed ($p<0.05$) while those fed maize-based diet consumed the least. Birds on 500mg PHY had the best ($p<0.05$) FCR value with those on maize diet having the poorest ratio. These results also agreed with that reported by (El-Tazi *et al*., 2009) which indicated that the body weight gain and feed intake were significantly improved by addition of phytase to broiler diet.

Table 2: Growth performance of broilers fed acha – based diets (0 – 7 weeks)

Parameters	Treatments					SEM
	Maize	Acha	Acha + 250mg PHY	Acha + 500mg PHY	Acha + 750mg PHY	
Initial weight(g)	39.00	39.00	39.00	39.00	39.00	0.00
Final weight(g)	1774.40^{b}	2002.08^{ab}	2105.12^{a}	2096.73^{a}	2141.67^{a}	85.60
Av.weekly wt gain (g/wk)	247.91^{b}	280.44^{ab}	295.16^{a}	293.96^{a}	300.38^{a}	12.23
Av. weekly feed intake (g/wk)	777.71^{c}	818.88^{bc}	916.61^{a}	821.12^{bc}	893.99^{ab}	25.97
FCR	3.14^{a}	2.93^{bc}	3.12^{a}	2.80^{c}	2.98^{b}	0.10
Cost/kg feed	209.66	327.16	327.19	327.23	327.27	0.55
Cost/kg gain	657.37^{b}	958.20^{a}	1021.34^{a}	916.61^{a}	974.08^{a}	32.32
Cost of feed consumed/bird	1141.39^{c}	1875.34^{b}	2099.35^{a}	1880.86^{b}	2048.03^{ab}	55.89
Weekly feed cost	163.06^{c}	267.91^{b}	299.91^{a}	268.69^{b}	292.58^{ab}	7.98

^{abc} means with different superscripts on the same row differ significantly ($P<0.05$); SEM = Standard error of means; PHY = phytase$^{(R)}$ Enzymes

Table 3 shows the prime cut of broilers fed the dietary treatments. Live weight, dressed weight, prime cuts (back and breast) and organ (full gizzard, empty gizzard, proventriculus and oesophagus) weights were significantly ($p<0.05$) influenced by dietary treatments. Live weight (1680.00 – 2300.00g) values were higher ($p< 0.05$) in birds fed acha with enzymes compared to

the maize and acha without enzyme fed birds. Live weights obtained were lower than those (2740.00 – 3023.33g) reported by Ukim *et al*. (2012) for broilers fed acha grains but comparable to values (1557.50 – 2212.50g) reported by Omojola *et al*. (2014) for broilers fed Sesame/Soybean based diets supplemented with or without phytase. Birds on the maize diet had higher ($p<0.05$) major prime cuts (back, breast and neck) followed by those on 500 mg PHY with higher ($p>0.05$) drumstick, thigh, wings and shank while acha without enzymes recorded the least drumstick, wings, neck, shank and head. This is an indication that acha without enzyme might not enhance broiler carcass yield.

Table 3.Prime cuts of broiler chickens fed acha – based diets

Parameters	Treatments					SEM
	Maize	Acha	Acha + 250mg PHY	Acha + 500mg PHY	Acha + 750mg PHY	
Live weight (g)	1683.00^{b}	1817.00^{b}	2017.00^{ab}	2000.00^{ab}	2300.00^{a}	117.60
Dressed weight (g)	1250.00^{b}	1333.00^{b}	1517.00^{ab}	1517.00^{ab}	1733.00^{a}	110.60
Dressing %	74.27	73.36	75.21	75.85	75.35	2.38
Prime cuts (% Live weight)						
Back	15.32^{a}	14.44^{ab}	13.96^{ab}	13.85^{ab}	12.22^{b}	0.71
Breast	16.63^{a}	15.37^{ab}	14.08^{bc}	13.97^{bc}	12.24^{c}	0.75
Drumstick	10.76	10.62	10.94	11.24	11.22	0.45
Thigh	12.04	12.89	12.60	12.95	12.02	0.73
Wings	8.87	8.39	9.13	9.47	8.89	0.36
Neck	5.61	5.08	5.42	5.59	5.15	0.25
Shank	3.96	3.63	3.92	4.25	4.00	0.28
Head	2.50	2.31	2.69	2.68	2.20	0.16

^{abc} means with different superscripts on the same row differ significantly ($P<0.05$); SEM = Standard error of means; PHY = phytase $^{(R)}$ Enzymes

The relative weights of full gizzard, empty gizzard, proventriculus, and oesophagus were significantly ($p<0.05$) influenced by dietary treatments (Table 4). Birds on maize diet recorded higher values for heart, full gizzard, empty gizzard, spleen, pancreas and gall bladder compared to those on acha – based diets. Higher heart weight obtained for maize diet comparable to those on acha diet could be an indication that maize diet could maintain the normal circulatory function in broilers. The lower gizzard weight in acha fed birds indicated that digestive process was not impaired by the utilization of acha. The relative organ weights observed were within the ranges previously reported (Odoemelam *et al*., 2017).

Table4: Relative organ weights of broilers fed acha–based diets

Organ (%LW)	Treatments					SEM
	Maize	Acha	Acha + 250mg PHY	Acha + 500mg PHY	Acha + 750mg PHY	
Heart	0.41	0.36	0.38	0.40	0.38	0.03
Liver	1.25	1.75	1.42	1.47	1.33	0.28
Full gizzard	3.17^{a}	2.19^{b}	2.37^{b}	2.42^{b}	2.32^{b}	0.20
Empty gizzard	2.44^{a}	1.40^{b}	1.76^{b}	1.75^{b}	1.76^{b}	0.13
Spleen	0.10	0.10	0.07	0.09	0.07	0.02
Lungs	0.46	0.47	0.50	0.46	0.43	0.04
Proventriculus	0.55^{ab}	0.69^{a}	0.43^{b}	0.47^{b}	0.40^{b}	0.06
Pancreas	0.21	0.20	0.18	0.20	0.17	0.03
Oesophagus	0.16^{ab}	0.13^{abc}	0.12^{bc}	0.17^{a}	0.12^{c}	0.01
Crop	0.31	0.30	0.25	0.32	0.24	0.03
Gall bladder	0.16	0.12	0.12	0.13	0.10	0.03
Trachea	0.13	0.12	0.11	0.16	0.12	0.02

^{abc} means with different superscripts on the same row differ significantly ($P<0.05$); SEM = Standard error of means; PHY = phytase $^{(R)}$ Enzymes

Conclusion and Recommendation

Results indicated that acha grains can be used in broiler diets without adverse effects on the growth and carcass performances of broilers. Phytase® supplementation improved acha utilization by broilers. For improved Acha utilization and optimum broiler growth up to 500mg of PHY should be included into broiler diets.

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