EFFECT OF FEED RESTRICTION AND ENZYME SUPPLEMENTATION ON PERFORMANCE, CARCASS CHARACTERISTICS AND COST BENEFIT OF MARSHAL BROILER CHICKEN

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Abstract
This study was conducted to investigate the effect of feed restriction with or without enzyme supplementation on performance, carcass characteristics, and cost benefit of broiler chickens for a period of fifty six days. Three hundred day-old Marshal Broiler chicks were used in a 3×2 factorial experimental layout to test the effect of feed restriction (FR) at 0, 15, and 30% of ad libitum feeding with two levels of Maxigrain(R) supplementation (ES) at 0 and 1000ppm. Data were collected on feed intake, weight gain, feed: gain ratio, mortality, carcass characteristics and cost benefit ratio. Data obtained were subjected to one way analysis of variance and significant mean separated. ES however improved the value obtained for these performance indices. Level of feed restriction had significant effect (P<0.05) on live weight, with (2115g) for bird on 0% level of restriction, followed by (2066g) for 15% and (1880g) for 30% level of feed restriction respectively. Hence, enzyme supplemented diet performed better than those chickens without enzyme inclusion in their diet. In conclusion, the trials showed that as the level of Feed restriction increases, feed cost /kg reduced and abdominal fat was reduced while enzyme supplementation enhanced feed utilization and improved the performance of the broilers subjected to feed restriction.

Key words: Feed restriction, Marshal Broiler, *Maxigrain®*, Final weight, Feed:gain

Introduction

Feed constitutes about 60-70% of production cost. Any reduction in feed consumption will reduce the cost of production, and directly increase the profit margin. (Oluyemi and Roberts, 2000). Feed restriction can be used during rearing to control mature body weight and reduce feed costs. Feeding strategies in growing broiler chickens should be aimed at optimizing lean carcass meat, feed conversion ratio (FCR) and body weight gain (Teimouri *et al.* 2005).

Feed enzymes have an important role to play in current farming system. They can increase the digestibility of nutrient leading to greater efficiency in the production of animal products such as meat and eggs. Poultry do not produce enzymes like cellulase, hemicellulase, xylanase and B-glucanase which are required for the digestion of cell wall component of plant material. About 85-90% of poultry feed consists of plant materials which contain large amount of dietary fibers. The nutritional strategy involving the use of commercial feed enzymes offer the potential to overcome the problems. Also, during feed restriction the bird may not get enough nutrient and even the little available may not be properly utilized hence the use of enzymes supplemented diet, make the available diet to be better utilized. (Wang *et al.*, 2005).

Materials and Methods

This Experiment was carried out at the poultry unit of Directorate of University farm, Federal University of Agriculture, Ogun State, Nigeria. The area is located on Latitude 7° 10 N and Longitude 3° 2 E. It receives a mean precipitation of 1037mm per annum an average temperature of 34.7°C and an average relative humidity of 82% throughout the year. (Google Earth, 2012).

Experimental Birds and management

Three hundred, Marshall day-old broiler chicks were acquired from a reputable hatchery in Abeokuta for this experiment. The birds were randomly distributed into 6 treatments with 5 replicates of 10 birds each. Experimental treatment consisted of 3 levels of quantitative feed restriction (0, 15 and 30 % of *ad libitum* feeding), with two levels of enzyme supplementation (0,1000ppm). A 23.35% crude protein experimental diet was formulated (Table 1). Birds were subjected to two weeks of feed restriction followed by realimentation for another two weeks.

Prior to the arrival of the birds the poultry house was thoroughly cleaned and disinfected .The feeder and drinkers were washed. Water was made available to the bird *ad libitum*. On arrival, the

birds were given water containing antistress and antibiotics (Keproceryl®) for five days. The brooding was done with kerosene stove and charcoal pot. The birds were reared on deep litter in pens measuring 3mx3m for each replicate. This trial lasted for eight weeks. The routine vaccination and medication regime for broilers were strictly adhered to.

Enzyme profile

The enzyme that was used for this experiment was Maxigrain® containing Cellulase, 10000 1U, Beta-Glucanase 200 IU, Xylanase 1000iU, and Phytase 2500 FTU marketed by Animal Care Consult Nig. Ltd.

Chemical analysis

The proximate analysis of the diets and faecal, samples were determined according to AOAC (2000).

Statistical Analysis:All data collected were subjected to analysis of variance (ANOVA) in 3 X 2 factorial arrangements within a completely randomized design. Significant ($P<0.05$) differences among variables were separated using Duncan's Multiple Range Test (SAS, 2001).

The birds were subjected to 6 treatment groups consisting of three level of quantitative feed restriction (0, 15 and 30% of *ad libitum* feeding), respectively with two levels of enzyme supplementation (-, +) at dosage 0 and 1000ppm of feed. The quantity of feed/week that was supplied for the control (ad *libitum*) was determined using the guide given by Aduku (2004).

Carcass characteristics

At 56th day of age, four birds in each replicate were selected on the basis of closeness to the replicate mean, weighed, tagged and deprived of feed overnight. The birds were selected on the basis of closeness to the replicate mean weight, deprived of feed overnight and slaughtered by slitting the throat. complete bleeding was ensured and feathers removed. The carcasses were weighed after removing heads, shanks and viscera to determine the percentage of carcass weight. The viscera (heart, liver, empty gizzard, and abdominal fat) were also weighed and percentage to live body weights calculated.

Results and Discussion

The nutrient content of the experimental diet was within the recommended nutrient requirement of broilers. In this study, after feed restriction of two weeks, the restricted birds had a significance lower body weight than the birds on *ad libitum* and this continues throughout the trial, more so the bird on enzyme supplemented diet had a better body weight gain compared than diet without enzyme. Also, the results indicated that the growth of broiler chicken is related to the feed intake supporting the evidence that the body weight gain of broiler chicken could be restricted by feed restriction (Summers *et al.*, 1990).

The result of these studies shows that the entire enzyme supplemented groups recorded a better feed efficiency than the diet that had no enzyme, best feed: gain was observed at 30% level of restriction compared to other diets. Hajati H. (2010), recorded a similar report.

Moreover the result of the cost benefit of Marshall Broiler chicken shows that as the duration of feed restriction increased, feed cost /kg reduced. Birds restricted at 30% level of feed restriction had the smallest production cost of N697.03 followed by 15% level of feed restriction and subsequently, N 835.25 at *ad libitum* feeding respectively.

Level of feed restriction had significant effect ($P<0.05$) on live weight, with (2115g) for bird on 0% level of restriction, followed by (2066g) for 15% and (1880g) for 30% level of feed restriction. There was decrease in weight across the restriction and this became more with increasing severity of feed restriction. The main effect of enzyme supplementation had significant ($P< 0.05$) effect on live weight, abdominal fat and breast weight of the retail cut part as those on enzyme supplemented diet performed better than those chickens without enzyme inclusion in their diet. In this study carcass characteristics were affected by feed restriction, weight of breast, was significant ($P<0.05$). Similarly, level of feed restriction had significant effect on the abdominal fat part; which decreases as the level of feed restriction increases. Planvnik and Harwortz (1983) reported a decrease in fat pad, with lower body weight gain in relation to the (ad *libitum)* birds.

Jones and Farell (1992) reported a large abdominal fat deposition in the carcass of restricted birds after realimentation. Enzyme supplementation increased carcass percentage, significantly ($p<0.05$).

Conclusion and Recommendation

As duration of feed restriction increased, feed cost /kg reduced. Moreover, the trials showed that as the level of FR increases, abdominal fat reduced while enzyme supplementation enhanced feed utilization and improved the performance of the broilers subjected to feed restriction.

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Table 1: Percentage composition of broiler starter and finisher diets

Ingredient	Composition (%) Without Enzyme		Composition (%) With Enzyme	
	Starter	Finisher	Starter	Finisher
Maize	50.00	55.00	50.00	55.00
Soybean meal	21.00	30.00	21.00	30.00
Wheat offal	12.00	5.00	12.00	5.00
Groundnut cake	10.00	3.80	10.00	3.80
Fish meal (72% CP)	2.00	1.00	2.00	1.00
Bone meal	2.50	2.50	2.50	2.50
Oyster shell	1.50	2.00	1.50 .	2.00
*Vitamin and Mineral premix	0.25	0.25	0.25	0.25
Lysine	0.25	0.1	0.25	0.1
Methionine	0.25	0.1	0.25	0.1
Salt (NaCl)	0.25	0.25	0.25	0.25
Enzyme (ppm)	-	-	+	+
TOTAL	**100.00**	**100.00**	**100.00**	**100.00**
Calculated Analysis				
Crude protein (%)	23.35	21.25	23.35	21.25
Crude fiber (%)	3.40	4.20	3.40	4.20
Ether extracts (%)	3.32	2.21	3.32	2.21
Cal (%)	1.32	1.95	1.32	1.95
P (%)	0.71	0.70	0.71	0.71
ME (Kcal/kg)	2822.38	2921.12	2822.38	2921.38
Determined Analysis (%)				
Dry matter	89.63	88.92	90.93	88.92
Crude protein	22.94	19.07	23.30	19.07
Crude fiber	3.84	3.52	3.72	3.52
Ether extract	3.56	3.47	3.63	3.47
Ash	5.20	5.56	5.62	5.56

**Premix composition per kg diet: Vit A: 400000IU, Vit D: 80000IU, Vit E: 40000ng, Vit K_3: 800mg, Vit B_1: 1000MG, Vit B_2: 6000mg, Vit B_6: 500mg, Vit B_{12}: 12.25mg, Niacin: 6000mg, Panthothenic acid: 2000mg, Folic acid: 200mg, Biotin: 8mg, Manganese:300000mg, Iron: 8000mg, Zinc: 20000mg, Cobalt: 80mg, Iodine: 400mg, Selenium: 40mg, Choline:800000mg*

** Enzyme 1000ppm*

Table 2: Effect of feed restriction and Enzyme supplementation on performance characteristics and Cost benefit of Marshal Broiler at finisher phase (0-8 weeks of age)

	Level of feed Restriction (%)			SEM	Enzyme supplementation		SEM
Parameters	0	15	30		-	+	
Initial weight(g)	43.00	43.19	42.78	0.96	43.11	43.16	0.50
Final weight (g)	2090.40^{a}	1956.00^{b}	1900.00^{c}	89.32	1948.90^{b}	2015.30^{a}	72.90
Total weight gain (g)	2047.4^{a}	1912.51^{b}	1857.22^{c}	89.36	1905.68^{b}	1972.58^{a}	72.80
Total feed intake(g)	4290.23^{a}	3646.50^{b}	3000.43^{c}	44.26	3648.39	3643.02	60.7
Daily feed intake (g)	76.61^{a}	65.12^{b}	53.58^{c}	0.78	65.14	65.05	1.14
Feed : gain	2.09^{a}	1.91^{b}	1.62^{c}	0.08	1.97^{b}	1.85^{a}	0.06
Total feed cost / bird	568.25^{a}	501.50^{b}	430.03^{c}	3.12	500.56	499.30	9.30
Total cost / bird	835.25	768.56^{b}	697.03^{c}	7.33	765.57	768.32	12
Cost efficiency	1749.98^{a}	1463.50^{b}	1108.26^{c}	35.33	1495.12	1495.00	79.00

$^{a, b, c,}$ mean in the same roll not sharing common superscript are significantly dif ferent (P<0.05) SEM: Standard error mean

Table 3 Ef fect of feed restriction and Enzyme supplementation on carcass characteristics of marshal Broiler at week 8

	Level of feed restriction (%)				Enzyme supplementation		
Parameters	0	15	30	SEM	-	+	SEM
Live weight (g)	2115.00^{a}	2066.00^{b}	1880.00^{c}	4.25	2007^{b}	2260^{a}	3.22
Dressing %	68.50	69.70	67.00	4.25	67.22	70.52	2.37
Abdominal fat (%)	1.34^{a}	0.83^{b}	0.63^{c}	0.53	0.69^{b}	1.21^{a}	0.34
up Retail cut –parts(1)							
Breast	20.22^{a}	19.40^{b}	18.35^{c}	1.52	18.10^{ab}	19.21^{a}	0.83

^{a,b,c}: means in the same row not sharing common superscript are significantly different (p<0.05)
SEM: Standard error mean
*1, 2, Expressed as percentages of live weight.