Original Research Article

Economics Benefits, Growth Performance, Carcass and Meat Characteristics of Broiler Chicken Fed High Fibre Diet

ABSTRACT

Aims: The effects of high fibre diet fed to broilers chicken on growth, carcass performance sensory evaluation, primal cuts and meat characteristics were carried out in a eight weeks feeding trials.

Methodology: A total of two hundred and forty Arbor Acer breed day old broiler chicks were obtained from a commercial hatchery was used for the trial. An average (33±0.12g body weight) were weighted individually and randomly divided into three (3) Treatment with ten replicate per treatment and eight birds per replicate using a completely randomized design. The diet contained T1= 8.70% fibre; T2= 13.10% with enzyme and T3= 13.10% fibre without enzyme. Parameters measured were the daily feed consumption, weekly body weights, weight gain and feed conversion ratio were properly recorded. Carcass performance parameters were measured and recorded for both the external and internal organs, primal cuts, sensory evaluation, cooking loss and yield using a standard procedure. Data were analysed using descriptive statistic and ANOVA at $\alpha_{0.05}$.

Results: There were no significant differences (P<0.05) for weight gain and feed conversion ratio while Treatment 3 had the highest daily feed consumption and weekly body weights with least daily feed consumption, and weekly body weights in Treatment 1. The result shows that there were not differs in carcass performance, external organs weight as well as internal organs weight There were no significant differences (P<0.05) observed in the primal cuts and sensory evaluation. The cooking loss was significantly higher in Treatment 1(control with 8.7% fibre) 33.36% with least cooking loss in Treatment 3 containing 13.10% (21.54%). Treatment 3 had the highest cooking yield (78.46%) compared to other treatment.

Conclusion: broiler chicken can be fed with 13.10% fibre diet without enzyme without any adverse effect on the growth, carcass performance, enhances better cooking yield and lower cooking loss.

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Keywords: Growth performance, carcass performance, high fibre diet, primal cuts, cooking loss, cooking yield, sensory evaluation

1. INTRODUCTION

The aim of farmers is to ensure high productivity and profitability. Due to the high competition for conventional feeding stuff such as maize between human and animal to meet

their energy requirement which has led to high cost of production and in turns reduce the profits [1]. Farmers has adopted the use of alternative feeding materials that are less or not consumed by humans and yet meets the energy requirement of animal such as broiler chicken. Such feeding material is fiber from cereals such as rice, corn, wheat and oat.

Fiber content of diets is mainly more important in ruminants; however, there are good results with fiber content in non-ruminants as pigs and poultry [2]. Fiber provides health benefits, with several physiological functions [3]. Also, fiber in feed ingredients may affect cecal microbial population, nutrient digestibility, and volatile fatty acid production. Interactions of these effects can affect bird performance and meat qualities [4]

Meat quality is greatly affected by the diet fed to the farm animal [5]. Diet is an important aspect of animal production, and different bird species or lines have different nutrient requirements depending on age, genetic background and environment as well as the health status of the birds. Thus, nutritionists are faced with a challenge of formulating diets with the available feed ingredients, but also having to mitigate the resulting diet effects to achieve optimum bird production [4].

Use of feed ingredients high in dietary fiber in poultry nutrition has generally been discouraged due to the negative effects exerted on nutrient utilization and performance such as decrease in body weight gain and feed conversion [4]. It is important to note that fibre in monogastric diets is mainly utilized in the hind gut (i.e. ceca, rectum and the colon). Feeding animals diets high in dietary fiber, particularly soluble fiber alters the rate of fecal passage, microbiota, metabolites, and efficacy of digestion [6].

Thus, this study is designed to investigate the Influence of high fibre diet fed to broilers chicken on growth, carcass performance, sensory evaluation and meat characteristics

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2. MATERIAL AND METHODS

2.1 Experimental site

The experiment was conducted at Poultry Unit Division of National Veterinary Research Institute, Vom, Plateau State, Nigeria.

2.2 Experimental animal and management:

A total of two hundred and forty Arbor Acer breed day old broiler chicks were obtained from a commercial hatchery was used for the trial. An average (33±0.12g body weight) were weighted individually and randomly divided into three (3) Treatment with ten replicate per treatment and eight birds per replicate. The brooding temperature was kept at an average of 26.5^{0}C from the first to second week of age. Thereafter, the temperature was lowered to 22^{0}C for the rest of experimental period. Wood shaving was used as litter material. At DOC, antibiotic and anti-stress were given to the birds for three days. From week two to three, first and second Infectious Bursal Disease Vaccine (IBDV) was administered. Then, at week four and five Anticocidial drug and Newcastle Disease Vaccine Lasota were given to the birds respectively. The experiment was conducted for the period of eight weeks. The daily feed consumption, weekly body weights, weight gain and feed conversion ratio were properly recorded. Carcass performance parameters were measured for both the external and internal organs.

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2.3 Experiment diet

Three experiment diets were formulated with high fibre content as shown in Table 1.

Table 1: Feed composition

Ingredients	T1	T2	T3
Lysine	0.35	0.35	0.35
Methionine	0.20	0.20	0.20
Premix	0.45	0.45	0.48
Salt	0.37	0.37	0.37
Enzyme	0.03	0.03	-
Toxin Blinder	0.02	0.02	0.02
GNC	27.90	27.90	27.90
Maize Bran	25.00	60.00	60.00

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Rice Bran	7.50	7.50	7.50
Bone Meal	2.40	2.40	2.40
Lime Stone	0.60	0.60	0.60
Oyatozyme	0.20	0.20	0.20
Maize	35.00	-	-
	100.016	100.016	100.016
Total Percentage	***100***	***100***	***100***

Nutrients Composition of Diets			
Metabolizeable energy (Kcal/Kg)	3197.00	2984.00	2716.00
Crude Protein %	18.16	18.50	17.83
Crude Fat %	7.40	9.15	9.15
Crude Fibre %	8.70	13.10	13.10
Ash %	5.20	6.24	6.24
Calcium %	1.50	1.50	1.22
Available Phosphorus %	0.67	0.72	0.42
Methionine %	0.49	0.46	0.46
Lysine %	0.95	1.00	0.96
Methionine + Cystine %	0.77	0.76	0.74

T1= Control (8.7% Fibre); T2= 13.10% Fibre with enzyme T3= 13.10% Fibre without enzyme

2.4 Sensory evaluation

The nine-point hedonic scale was used by twenty panelists who were trained individuals aged between 20 and 40 years were used to determined two replicate of the prepared sausage to assess colour (1-4 dark, 5- intermediate, 6-9 light), tenderness (1-4 tough, 5-intermediate, 6-9 tender), juiciness (1-4 dry, 5- intermediate, 6-9 juicy), and overall acceptability, OA (1-4 low, 5- intermediate, 6-9 high) [7].

2.5 Cooking loss

Cooking loss was determined according to the procedure described by [7]. Meat samples from each treatment and major primal cuts were taken, weighed before cooking for 10 minutes after the water in the cooking pot had boiled. Cooked samples were allowed to cool then weighed. Cooking loss was calculated using:

$$\text{Cooking loss \%} = \frac{\text{weight of sample before cooking} - \text{weight of sample after cooking}}{\text{weight of sample before cooking}} \times 100$$

2.6 Experimental design

Completely randomized design was used.

2.7 Statistical Analysis

Data obtained were subjected to analysis of variance using [8]. The means were separated using Duncan's Multiple Range Test of the same procedure.

3. RESULTS AND DISCUSSION

The economics benefit of feeding broilers with high fibre diet is shown in Figure 1 and cost of production is shown in figure 2. Feed production cost was higher in T1 = 114.09 naira per kg, T2 = 97.03 naira per kg while least feed cost at T3 = 92.62 naira per kg. The growth performance was shown in Table 2. The fiber had no effect on both the weight gained and FCR among the treatments. The feed intake /week/ replicate was higher in Treatment 3 with least values in Treatment 1. Furthermore, the feed intake/bird/week was also higher in both Treatment 2 and 3. In agreement with previous reports [9], [10], and [11], broiler chicks' body weight gain was reduced at higher concentrations of high fiber dietary ingredients which was in line with the findings of the study, although there was no significant difference in the weight gained. A possible explanation for the reduced performance could be that inclusion of high fibre source in broiler diets.

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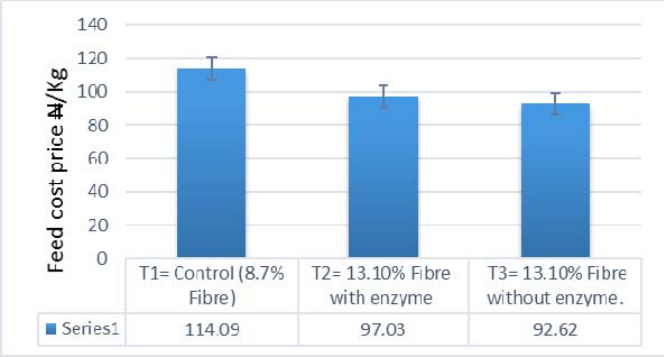

Figure 1: Economics benefits

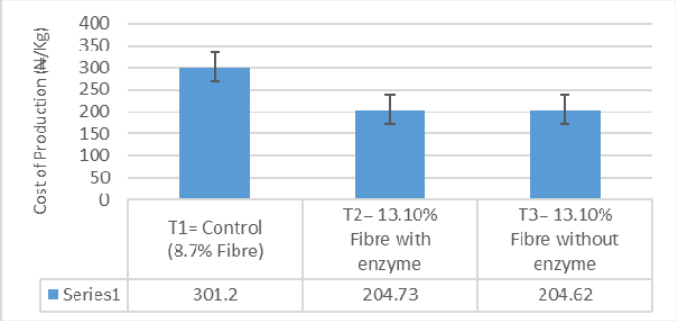

Figure 2: Cost of Production as affected by high fibre diet fed broilers chicken

Table 2: Growth performance of broiler chicken fed high fibre diet

Parameters	T1	T2	T3	SEM
Initial weight	39.78	39.7	39.75	0.24
Final weight	1478.00	1850.00	1633.33	83.56
wgt gain/wk	239.84	271.20	265.60	12.15
FI/WK/REP	8077.39^{b}	9999.97^{a}	10111.31^{a}	374.27
FI/Bird/wk	479.18^{b}	566.23^{a}	561.74^{a}	16.68
FCR	2.64	2.11	2.21	0.22
Cost of Production N/kg	301.2a	204.73b	204.62b	16.34

^{a,b,c} Means across rows with different superscripts differ significantly at P<0.05; wgt: Weight; wk: Week; FI; Feed Intake; F.C.R: Feed Conversion Ratio;. S.E.M: Standard Error of the Mean

T1= Control (8.7% Fibre); T2= 13.10% Fibre with enzyme T3= 13.10% Fibre without enzyme.

Table 3: Carcass performance as affected by high fibre diet

Parameters	T1	T2	T3	SEM

Live Weight	2.12	2.30	2.30	0.07
Bled Weight	2.02	2.21	2.22	0.07
Defeathered weight	1.95	2.11	2.12	0.07
Evicerated Weight	1.71	1.84	1.83	0.06
Dressed Weight	1.44	1.58	1.57	0.06
Dressed percentage	68.29	68.78	68.31	0.18

[a,b,c] Means across rows with different superscripts differ significantly at P<0.05
T1= Control (8.7% Fibre); T2= 13.10% Fibre with enzyme T3= 13.10% Fibre without enzyme.

Table 4: External organs of broilers as affected by high fibre diet

Parameters	T1	T2	T3	SEM
Head	56.00	57.00	56.67	1.24
Neck	90.00	100.00	101.33	2.93
Shank	87.00	94.33	93.33	2.22
Abdominal fat	14.67	21.67	26.67	3.17

[a,b,c] Means across rows with different superscripts differ significantly at P<0.05
T1= Control (8.7% Fibre); T2= 13.10% Fibre with enzyme T3= 13.10% Fibre without enzyme.

Table 5: Internal organs of broilers as affected by high fibre diet

Parameters	T1	T2	T3	SEM
Liver Weight	2.01	1.90	2.13	0.08
Heart Weight	0.53	0.51	0.49	0.03
spleen weight	0.20	0.17	0.13	0.02
bile weight	0.05	0.13	0.10	0.02
Gizzard Weight	2.57	1.91	2.40	0.14
Empty gizzard	1.65	1.41	1.68	0.09
Intestine weight	5.23	4.79	4.53	0.21
Intestine length	11.18	10.10	8.28	0.61
Proventriculus	0.29	0.31	0.35	0.03

[a,b,c] Means across rows with different superscripts differ significantly at P<0.05
T1= Control (8.7% Fibre); T2= 13.10% Fibre with enzyme T3= 13.10% Fibre without enzyme.

Table 3, 4 and 5 showed that treatments had no significant effect on both the external and internal organs such as weights of necks, heads, shanks, abdominal fat, livers, hearts, spleens, bile, gizzards, empty gizzards, intestinal weight, intestinal length and proventriculus, as these parameters did not show differences across the diets. The result

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obtained could be due to include higher total intake of high fiber feed ingredients in the broiler chicks resulting in reduced both the internal and external organs.

Table 6 shows the primal cuts of broilers chicken fed high fibre diet. Comparing the thigh, drumsticks, back, breast meat and wings across the treatment shows no significant difference. Besides, the colour, aroma, flavor, juiciness, tenderness, texture and overall acceptability examined under sensory evaluation shows no difference among the treatment as shown in Table 7. Similar result was obtained by [12], who compared chicken groups fed high fibre did not differ in terms of juiciness, flavour, overall acceptance, and general acceptance. The cooking loss and yield of meat from broilers chicken fed high fibre diet is represented in Table 4. The cooking loss of breast meat from broilers chicken fed control (8.70% fibre) had the highest cooking loss with least cooking loss in Treatment 3. While Treatment 3 had the highest cooking yield with lowest cooking yield in Treatment 1. Meanwhile both the cooking loss and yield for drumstick and thigh shows no significant difference. The result obtained could be due to ability of the high fibre to hold water within the muscle of the broilers chicken.

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Table 6: Primal cuts of broilers chicken fed high fibre diet.

Parameters (g)	T1	T2	T3	SEM
Thigh	266.67	286.67	263.67	14.19
Drumstick	209.33	222.67	231.33	8.26
Back	277.00	312.33	335.67	14.69
Breast	511.33	569.00	554.00	22.63
Wings	161.67	173.67	173.33	5.49

[a,b,c] Means across rows with different superscripts differ significantly at P<0.05
T1= Control (8.7% Fibre); T2= 13.10% Fibre with enzyme T3= 13.10% Fibre without enzyme.

Table 7: Sensory evaluation of meat from broilers chicken fed high fibre diet

Parameters	T1	T2	T3	SEM
Colour	5.10	4.80	4.80	0.29
Aroma	3.60	2.10	3.50	0.38
Flavour	3.60	3.30	3.50	0.29

Juiciness	5.30	4.00	4.00	0.36
Tenderness	5.00	5.10	5.00	0.29
Texture	4.30	4.40	4.50	0.29
Overall acceptability	4.30	3.50	3.10	0.34

[a,b,c] Means across rows with different superscripts differ significantly at P<0.05
T1= Control (8.7% Fibre); T2= 13.10% Fibre with enzyme T3= 13.10% Fibre without enzyme.

Table 8: Cooking loss and yield of meat from broilers chicken fed high fibre diet

Parameters	Primal cuts	T1	T2	T3	SEM
Cooking loss	Breast	33.36[a]	24.74[b]	21.54[b]	2.16
	Drumstick	28.17	21.15	19.62	2.93
	Thigh	29.29	24.48	22.42	2.11
Cooking yield	Breast	66.64[b]	75.26[a]	78.46[a]	2.16
	Drumstick	71.83	78.85	80.38	2.93
	Thigh	70.71	75.52	77.58	2.11

[a,b,c] Means across rows with different superscripts differ significantly at P<0.05
T1= Control (8.7% Fibre); T2= 13.10% Fibre with enzyme T3= 13.10% Fibre without enzyme

4. CONCLUSION

In conclusion, broiler chicken can be fed with 13.10% fibre diet without enzyme without any adverse effect on the growth, carcass performance, enhances better cooking yield and lower cooking loss with least cost of feed production. The most important theory that this work seems to suggest is the higher the fiber content of broiler diet, the less the cost of production holding the enzyme constant.

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