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EVALUATION OF EFFECT OF FEEDING DIFFERENT PLANT PROTEIN SOURCES ON GROWTH AND ECONOMIC PERFORMANCE OF BROILER CHICKENS IN THE SEMI-ARID REGION OF NIGERIA

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ABSTRACT

The effect of feeding different protein sources on growth and economic performance of broiler chickens was investigated. A total number of one hundred and twenty (120), four week-old chicks were randomly allotted to four dietary treatments of thirty chicks per treatment. Each treatment had 3 replicates with ten chickens per replicate. The groundnut cake, soybean meal, sunflower meal and sesame meal were incorporated in diets 1 2, 3 and 4, respectively. The experiment lasted 28 days (4 weeks). The parameters measured were daily feed intake, daily weight gain, feed conversion ratio, and economic analysis. There were significant ($p< 0.05$) differences in final body weight gain, daily feed intake and feed conversion ratio. The chickens fed T1 (57.22 g/bird) (groundnut cake) diet recorded heavier body weight compared to other treatments groups. However, chickens fed T2 (201.39 g/bird) and T3 (197.13 g/bird) diets had the higher daily feed intake while the lower values were recorded in those fed T1 (167.87g/bird) and T4 (178.70g/bird) diets. The best feed conversion ratio was obtained in broiler chickens fed T1 (2.04) diet and poorest was revealed in those fed T2 (4.82). The feed cost per Kg (₦/Kg) showed that in T1 (groundnut cake) based-diets had the lowest cost than other diets. The highest cost per gain (₦/Kg) was obtained in broiler chickens fed T4 (sesame meal) diet. Therefore, based on these findings the use of the groundnut cake in the diet is more economical for broiler finisher production in Semi-Arid region in Nigeria.

Keywords: Broiler chickens, Different plant sources, Growth and economic performance

INTRODUCTION

One of the major challenges in Nigeria is the satisfaction of the ever-increasing demand for protein. Most Nigerian diets are deficient in animal protein. FAO (2010) recommends that the minimum intake of protein by an average person should be 65g per day; of this 36g (that is 40%) should come from animal sources. The country is presently unable to meet this requirement. The animal protein consumption in Nigeria is about 15g per person per day (Ojo *et al*., 2003) which is far from the FAO recommendation. As a result, wide spread hunger, poor and stunted growth as well as increase in spread of diseases in the country is on the increase.

Animal protein sources include beef, fish, egg, poultry meat, beacon, pork and mutton among others. However, these protein sources are not affordable. The common sources accessible to most Nigerians are frozen fish, beef, and local chickens. Ojo *et al*. (2003) has reached a consensus that intensification of production of meat and egg derived from prolific animals like poultry rabbit and pig are necessary to meet the protein requirement of Nigerians. High cost of feed is one of the most important factors that determine the supply of animal protein to Nigerians. Animal feed are not readily available and where they are available are not easily affordable for an average farmer. Since farmers go into animal production for protein and to not only break-even; but also make

reasonable profit in the business. The ruminant which can still be fed on pasture and forages or allow scavenging for feed but broiler chicken is quite not possible, due nature and digestive system. Perhaps high cost of feeds, has demand research alternatives have been sought to meet up with the requirement for animal feed which include the use of locally available alternative feedstuffs to supplement and the use of non-conventional feed resources (Ben Salem *et al.*, 2004). Thus, the objective of this study is to investigate the effect of using four different plant protein sources on the growth and economic performance of broiler chickens in the semi-arid region of Nigeria.

MATERIALS AND METHODS

Location of the study

The study was conducted at the Livestock Teaching and Research Farm, Department of Animal Science, University of Maiduguri, Maiduguri, Borno State, Nigeria. Maiduguri is located on latitude 11^{o} 15' North and longitude 30^{o} 05' East and on an altitude of 345 m above sea level. The relative humidity ranges from 30 to 50% (Encarta, 2007). The rainfall is between 500 to 600 mm. It has a short period of rainfall (3 to 4 months) usually from June to September followed by long period of dry season (8 to 9 months) (Encarta, 2007).

Experimental diets

The Table 1 shows the composition of the experimental diets. Four experimental diets containing different plant protein sources were formulated using the following ingredients: Maize, wheat offal, groundnut cake, soybean meal, sunflower meal, sesame meal, fish meal, bone meal, common salt and premix. The groundnut cake, soybean meal, sunflower meal and sesame meal were incorporated in diets 1, 2, 3 and 4, respectively.

Table 1: Composition of the experimental diets for broiler finisher

	Treatments/Diets			
Ingredients	**T1**	**T2**	**T3**	**T4**
Maize	62.00	62.00	62.00	62.00
Groundnut cake	21.00	0.00	0.00	0.00
Soybean meal	0.00	21.00	0.00	0.00
Sunflower meal	0.00	0.00	21.00	0.00
Sesame meal	0.00	0.00	0.00	21.00
Wheat offal	8.50	8.50	8.50	8.50
Fish meal	5.00	5.00	5.00	5.00
Bone meal	3.00	3.00	3.00	3.00
Salt (NaCl)	0.30	0.30	0.30	0.30
Premix*	0.20	0.20	0.20	0.20
Total	100.00	100.00	100.00	100.00

** Premix (grow fast) Manufactured by Animal Care Service Consult (Nig) Ltd. Lagos, Supplying the following per kg of premix: Vitamin A, 5000,000 IU; Vitamin D_3 800,000IU; Vitamin E, 12,000mg; Vitamin K, 1,5000mg; Vitamin B_1, 1,000mg; Vitamin B_2, 2,000mg, Vitamin B_6, 1,500mg; Niacin, 12,000mg; Pantothenic acid, 20.00mg; Biotin,10.00mg; Vitamin B_{12}, 300.00mg; Folic acid, 150,000mg; Choline, 60,000mg; Manganese, 10,000mg; Iron;15,000 mg, Zinc 800.00mg; Copper 400.00mg; Iodine 80.00mg; Cobalt 40mg; Selenium 8,00 mg* *Key:* T1= Groundnut cake; T2= Soybean meal; T3= Sunflower meal and T4= Sesame meal

Experimental birds

One hundred and twenty (120), four week-old chicks were randomly divided into 4 groups of 30 birds each. Each group was further subdivided into 3 replicates of 10 birds each. The 4 groups were randomly assigned to the

experimental diets in a completely randomized design (CRD). The birds were housed on a concrete floor pen measuring 1.8 m^2 covered with wood shaving at the Animal Science Department Teaching and Research Farm University of Maiduguri, Nigeria. The birds were vaccinated against Gumboro disease at weeks 2 and 5 and Newcastle disease at week 3. The diets and clean drinking water were supplied *ad libitum* during the period of the experiment. The finisher diets were fed for 4 weeks during the period of the experiment.

Data collection and analysis

Daily feed intake was obtained by subtracting the left-over from total amount of feed supplied. Each bird was weighed at the inception of the experiment and weekly thereafter to obtain the weekly and daily weight gain throughout the experimental period. The feed conversion ratio was calculated as the dry matter feed intake per unit weight gain. Mortality was recorded as they occurred. The proximate analysis of the experimental diets was carried out according to AOAC (2000).

Economic parameters

Economic parameters were estimated thus as follows: Feed cost/Kg was calculated as the total cost of feeds (₦) divided by total weight of feeds (Kg) while Feed cost/weight gain was calculated as

$$\frac{\text{Total feed intake (Kg) x feed cost/Kg}}{\text{Total weight gain (Kg)}}$$

Statistical analysis

All the data collected were subjected to analysis of variance (ANOVA) appropriate to the completely randomized design (Steel and Torrie, 1980). Means were separated, where applicable, using the Duncan's multiple range test (Duncan, 1955). A computer package (Statistix 9.0) was used for the analysis.

RESULTS AND DISCUSSION

Proximate composition of the experimental diets

The result of the proximate composition of experimental broiler finisher diets is presented in Table 2. The crude protein contents of the experimental diets were numerically similar. The crude protein values were within the range (20 - 22% CP) as recommended by NRC (1994) and Olomu (2011) as the optimum protein level required for broiler finisher in the tropics. The chickens fed T3 (sunflower meal) diet recorded the highest crude fibre compared to other diets with similar values. The crude fibre content values were comparable to the levels (5 to 8%) as the ideal fibre in broiler finisher diet as reported by Kekeocha (1984) and Olomu (2011). The ether extract values were also numerically similar among the treatments. The highest ash content was reported in T3 (sunflower meal) while the lowest value was reflected in T1 (groundnut cake). The highest metabolizable energy (ME) level was recorded in T1 (3279.42 Kcal/Kg) while the lowest value was obtained in T4 (3018.88 Kcal/Kg). However, the metabolizable energy levels of the experimental diets were within the recommended energy levels as reported by NRC (1994) and Olomu (2011) for broiler finisher diets in the tropics. This is an indication that all the diets can support growth production.

Table 2: Proximate composition of the experimental diets (%)

	Treatments/Diets			
Parameters	**1**	**2**	**3**	**4**
Dry matter	95.20	95.20	96.70	96.40
Crude protein	21.10	21.04	19.11	20.03
	8.21	8.03	11.84	8.27
Crude fibre				
Ether extract	8.01	7.56	7.85	8.61
Ash	10.57	10.91	13.99	11.91
NFE	52.11	47.54	47.21	51.18
ME (Kcal/kg)	3279.42	3078.03	3018.88	3255.41

Key: T1= Groundnut cake, T2= Soya bean meal, T3= Sunflower meal and T4= Sesame meal
ME = Metabolizable energy calculated according to the formula of Pauzenga (1985):
ME = 37x% CP+81x%EE+35.5 x %NFE NFE = Nitrogen-free extract

Growth performance of broiler chickens fed diets containing different plant protein sources

Growth performance of broiler chickens fed diets containing different plant protein sources is presented in Table 3. There was no significant ($p<0.05$) difference observed between the initial body weights and daily weight gain among the treatment groups. The significant ($p<0.05$) variation was observed between the final body weight gain, daily feed intake and feed conversion ratio (FCR). The broiler chickens fed T2 (201.39 g/bird) and T3 (197.13 g/bird) consumed more feed compared to other treatment with similar values. The daily fed intake obtained in this study was similar to the values reported by Abro *et al.* (2012). Chickens fed T1 (167.87 g/bird) had the heavier final body weight compared to other treatment groups with similar values. This result agreed with the findings of Abro *et al.* (2012) who fed different plant protein sources and obtained similar final body weight as well as daily weight gain. The best feed conversion ratios (FCR) were observed in T1 (2.04) and the poorest was revealed in T2 (4.82), but T2 (groundnut cake) did not differ ($p< 0.05$) from those fed T3 (4.09l) and T4 (4.12) diets, respectively.

Table 3: Growth Performance of Broiler Chickens fed Different Plant Protein Sources

Parameters	**1**	**2**	**3**	**4**	**SEM**
Initial weight (g/bird)	1219.20	1217.20	1221.60	1219.90	36.44^{NS}
Final weight (g/bird)	2823.60^{a}	2498.10^{b}	2555.60^{b}	2422.20^{b}	46.12^{*}
Daily Feed intake (g/bird)	167.87^{b}	201.39^{a}	197.13^{a}	178.70^{b}	3.26^{*}
Daily weight gain (g/bird)	57.22	45.58	47.06	42.33	3.48^{NS}
Feed conversion ratio	2.04^{b}	4.82^{a}	4.09^{a}	4.12^{a}	0.48^{*}
Mortality	0.00	0.00	0.00	0.00	-

Key: T1= Groundnut meal, T2= Soya bean meal, T3= Sunflower meal and T4= Sesame seed meal SEM = Standard error of mean; NS = Not significant ($P>0.05$) and * = Significant ($P<0.05$)
a,b, = Means in the same row bearing different superscripts differ significantly ($P<0.05$

Economic analysis

The economic analysis of broiler chickens fed formulated diet with different plant protein sources is presented in Table 4. The highest feed cost per kilogram was revealed in T4 (Sesame seed meal) ₦100.19 and the lowest value was observed in T1 (Groundnut cake) ₦89.69. The variation could be due to different prices of plant protein sources at the time of the studies. The best cost/kg was recorded in T1 (Groundnut cake) while the poorest were observed in T2 (Soybean meal) and T4 (Sesame seed meal), respectively. Therefore, based on the finding of the study, farmer should use groundnut cake as their plant protein sources rather than other plant protein sources in Semi-Arid Region of Nigeria.

Table 4: Economic production of broiler chickens fed different Protein Sources

	Treatments/Diets			
Parameters	**1**	**2**	**3**	**4**
Initial body weight (g/bird)	1219.20	1217.20	1221.60	1219.90
Final body weight (g/bird)	2823.60	2498.10	2555.60	2422.20
Total feed intake/bird (g)	3525.27	4229.19	4139.73	3752.70
Total feed intake/bird (kg)	3.53	4.23	4.14	3.75
*Cost of feed (₦/kg)	89.69	94.94	95.99	100.19
Total weight gain/bird (g)	893.55	747.18	778.26	701.40
Total weight gain/bird (kg)	0.89	0.75	0.79	0.70
Feed cost per Kg gain (₦/kg)	355.74	535.46	503.04	536.73

Key: T1= Groundnut meal, T2= Soya bean meal, T3= Sunflower meal and T4= Sesame seed meal
* Cost per kilogram of the various ingredients used in compounding the experimental diets: Maize ₦ 84.00; soya bean, ₦125.00; wheat offal ₦ 60.00; groundnut cake, ₦ 100.00; sunflower meal, ₦130.00; sesame meal, ₦150.00; fish meal, ₦140.00; bone meal, ₦55.00; salt, ₦20.00 and premix, ₦ 1,400.00

CONCLUSION

From the results of this study, it can be concluded that inclusion of groundnut cake in the diet of broiler chickens had best growth and economic production compared to other plant protein sources in Semi-Arid Region of Nigeria.

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