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Comparative Evaluation of Maize and Soyabeans as Energy Sources for Broiler Chickens

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Abstract: A total of one hundred and thirty-five (135) unsexed broiler chickens of 5 days of age averaging 72.22 ± 1.11 grams were randomly allocated into 3 dietary treatments designated I, II and III such that full-fat soyabean and maize respectively each predominate (weight for weight) in diets on the one hand while each of the two ingredients were in equal proportions on the other hand. The results at the starter phase show that feed intake and weight gain were not adversely affected ($p > 0.05$) by birds fed all diets. However, the diet which contained the highest level of full-fat soyabean supported insignificantly higher weight gain and efficiency of feed utilization. The results also show that efficiency of feed utilization of birds fed all diets were not significantly affected ($p > 0.05$) while feed cost per unit weight gain of the birds fed the diet where soyabean predominated were significantly better ($p < 0.05$) than birds fed other diets. The results at the finishing phase however show that there were no significant differences ($p > 0.05$) in feed intake, weight gain, efficiency of feed utilization and feed cost per unit weight gain among birds fed diets containing either higher levels of maize or soyabeans. It was observed in the present study that bird fed the diet that contained higher levels of maize had insignificantly ($p > 0.05$) better performance characteristics than those fed the diet that contained higher level of soyabeans. On the basis of the results obtained, it may be recommended that either higher levels of maize or full-fat soyabean may be used as energy sources for broiler starter and finishing broiler chickens without any adverse effect on their performance when prices of each feed ingredients do not differ much.

Key words: Maize, full-fat soyabean, broilers

INTRODUCTION

Maize and soyabean have been the most conventionally used sources of energy and protein respectively in the diets of monogastric animals (pigs and poultry). Maize is the widely used cereal grain in human and animal feeding in many parts of the world. It is also a source of industrial gums and recently fuel. Similarly, full-fat soyabean is an excellent source of vegetable oil, containing about 18% (Aduku, 1993). Obioha (1992) reported that fats and oils yield about 2.25 times more energy than equivalent amount of carbohydrate and/or protein. Pond *et al.* (1995) reported that where energy becomes limiting, excess protein in feedstuffs could be deaminated and the carbon skeleton used to support energy. These workers also reported that full-fat soyabean contains an excellent amino acid profile comparable to animal protein.

The metabolizable energy content of full-fat soyabean and maize for many monogastric animals are similar (Carew *et al.*, 2007). Thus, when prices do not differ much, they may become alternatives as energy sources. This is particularly so in most maize and soyabean producing communities like Benue State. According to

Aduku (1993), the metabolizable energy content for maize and full-fat soyabean is 3432 and 3300 Kcal/kg respectively. Carew *et al.* (2007) therefore compared maize and full-fat soyabean as energy sources for rabbits and reported that these feed ingredients can be complementarily used as energy sources. This is the reason for the present study where maize and full-fat soyabean respectively each predominate in diets on the one hand and when each of the two ingredients are used in equal proportions on the other hand in diets and evaluating same on the performance of broiler starter and finishing broiler chickens.

MATERIALS AND METHODS

The maize and soyabean used in the present study was obtained from Gboko town, Benue State. The soyabean was manually roasted to rid the feedstuff of the presence of anti-nutritional factors. The particle size of each of maize and soyabean was then reduced by grinding with a hammer mill.

Experiment 1: A total of one hundred and thirty-five (135) unsexed broiler chickens of 5 days of age averaging

72.22±1.11 grams were purchased from a commercial vendor and randomly allocated into 3 dietary treatments designated I, II and III of 45 birds in each treatment. Each treatment was replicated 3 times with each replicate having 15 birds such that full-fat soyabean and maize respectively each predominate (weight for weight) in diets on the one hand (Diets I and III respectively) while each of the two ingredients were in equal proportions (Diet II) (Table 1). The birds were reared according to standard procedures (Dafwang and Ogundipe, 1982). The chicks were maintained on these diets and water being provided *ad libitum* until they were four weeks old. Records of feed consumed and live weight changes were kept for 28 days.

Experiment 2: At the end of experiment 1, the birds averaging 586.67±1.67 grams were pooled together and randomly allocated into 3 dietary treatments designated I, II and III for finishing broiler chickens such that full-fat soyabean and maize respectively each predominate (weight for weight) in diets on the one hand (Diets I and III respectively) while each of the two ingredients were in equal proportions (Diet II) (Table 2). The birds were given feed and water *ad libitum* until they were eight weeks old, observing standard broiler production practice and keeping records of feed consumed and live weight changes for 28 days.

Data analysis: Data on each parameter was subjected to the Analysis of Variance (ANOVA) for Completely Randomized Design (CRD) and where significant differences were indicated, the means were separated using Hsu's MCB (Multiple Comparison with the Best) method (Minitab, 1991).

RESULTS AND DISCUSSION

The summary of results of the response of broiler starter chickens fed diets in which full-fat soyabean and maize respectively each predominate (weight for weight) in diets on the one hand and when each of the two ingredients were in equal proportions on the other hand are presented in Table 3 while the response at the finishing phase are presented in Table 4.

As the results of the response of broiler starter chickens have shown, feed intake and weight gain were not adversely affected ($p>0.05$) by birds fed all diets. In the present study, diet I which contained the highest level of full-fat soyabean supported insignificantly higher weight gain and efficiency of feed utilization. However, feed intake was highest when soyabean predominated in the diet and lowest when equal proportions of maize and soyabean were fed.

The results also show that efficiency of feed utilization (expressed as the ratio of feed intake to weight gain) and feed cost per unit weight gain of the birds fed the diet where soyabean predominated were better than birds

Table 1: Percent composition of broiler starter test diets

Ingredients	Dietary treatments		
	I	II	III
Maize	36.00	44.00	52.00
FFRSB ^a	52.00	44.00	36.00
Rice offal	8.00	8.00	8.00
Bone ash	3.00	3.00	3.00
Common salt (NaCl)	0.25	0.25	0.25
Mineral-Vitamin Premix	0.25	0.25	0.25
DL- Methionine	0.25	0.25	0.25
L-Lysine HCl	0.25	0.25	0.25
Total	100.00	100.00	100.00
Crude protein (%)	23.56	21.24	18.92
ME (Kcal/kg)	3020	3028	3036
Crude fibre (%)	5.50	5.22	4.94
Ether Extract (%)	11.36	10.24	9.12
Calcium (%)	1.28	1.27	1.25
Phosphorus (%)	0.98	0.94	0.90
Methionine (%)	0.67	0.63	0.59
Lysine (%)	1.82	1.62	1.41
Meth. + Cystine (%)	0.93	0.88	0.82
Feed cost/kg (₹/kg)	67.02	66.22	65.42

ME = Metabolizable Energy (Kilocalories per kg of diet); a = Full-fat roasted soyabean

Table 2: Percent composition of broiler finisher test diets

Ingredients	Dietary treatments		
	I	II	III
Maize	46.00	43.00	40.00
FFRSB ^a	40.00	43.00	46.00
Rice offal	10.00	10.00	10.00
Bone ash	3.00	3.00	3.00
Common salt (NaCl)	0.25	0.25	0.25
Mineral-Vitamin Premix 0.25	0.25	0.25	0.25
DL-Methionine	0.25	0.25	0.25
L-Lysine HCl	0.25	0.25	0.25
Total	100.00	100.00	100.00
Crude protein (%)	20.04	20.91	18.88
ME (Kcal/kg)	2984	2984	2988
Crude fibre (%)	5.52	5.67	5.38
Calcium (%)	1.26	1.26	1.25
Ether extract (%)	9.74	10.16	9.18
Phosphorus (%)	0.95	0.97	0.95
Methionine (%)	0.61	0.62	0.59
Lysine (%)	1.56	1.68	1.52
Meth. + Cystine (%)	0.85	0.87	0.82
Feed cost/kg (₹/kg)	64.70	65.00	64.30

ME = Metabolizable Energy (Kilocalories per kg of diet); a = Full-fat roasted soyabean

fed other diets. However, efficiency of feed utilization of birds fed this diet was not significantly better ($p<0.05$) than those fed the diet where maize predominated. It was observed in the present study that the efficiency of feed utilization and feed cost per unit weight gain of birds fed diets containing when equal proportions of maize and soyabean were significantly inferior ($p<0.05$) to birds fed other diets.

Similarly, as the results of the response of finishing broiler chickens have shown, there were no significant differences ($p>0.05$) in feed intake, weight gain,

Table 3: Response of broiler starter chickens fed maize and full-fat soyabeans as energy sources

Parameters	Dietary treatments			SEM
	I	II	III	
Average final weight (g)	656.98 ^a	514.77 ^c	585.23 ^b	19.45
Initial average weight (g)	71.11	72.00	73.33	2.63 ^{NS}
Average daily weight gain (g)	20.93	15.82	18.28	5.26 ^{NS}
Average daily feed intake (g)	50.15	43.14	47.58	9.81 ^{NS}
Feed conversion ratio	2.36 ^a	3.76 ^b	2.81 ^a	0.84
Feed cost per unit weight gain (₦/gain)	158.34 ^a	249.15 ^b	183.50 ^a	55.43

^{a,b}Means followed by the same superscript in horizontal rows are not significantly different from one another (p>0.05). SEM = Standard Error of Mean; NS = Not significantly different from one another (p>0.05)

Table 4: Response of finishing broiler chickens to maize and full-fat soyabeans as energy sources

Parameters	Dietary treatments			SEM
	I	II	III	
Average final weight (g)	1566.33 ^a	1138.00 ^c	1402.67 ^b	-
Initial average weight (g)	588.33	585.00	586.67	-
Average daily weight gain (g)	34.94 ^a	19.77 ^b	29.13 ^a	5.85
Average daily feed intake (g)	108.87 ^a	88.63 ^b	106.58 ^a	9.88
Feed conversion ratio	3.12 ^a	4.48 ^b	3.66 ^a	0.63
Feed cost per unit weight gain (₦/gain)	201.86 ^a	291.20 ^b	235.34 ^a	40.61

^{a,b}Means followed by the same superscript in horizontal rows are not significantly different from one another (p>0.05). SEM = Standard Error of Mean; NS = Not significantly different from one another (p>0.05)

efficiency of feed utilization and feed cost per unit weight gain among birds fed diets containing either higher levels of maize or soyabeans. It was observed in the present study that birds fed the diet that contained higher levels of maize had insignificantly (p>0.05) better performance characteristics than those fed the diet that contained higher level of soyabeans. This performance characteristics were however significantly (p<0.05) depressed when maize and soyabeans were fed in equal proportions.

The metabolizable energy content of the feed is the major determinant of feed intake (Grobner *et al.*, 1985). Since the chicken is known to be especially sensitive to dietary energy concentration (Scott *et al.*, 1982), the non-significant effect of feed intake and hence weight gain could have been due to the iso-caloric nature of all the diets on the one hand and the fact that maize and full-fat soyabean contain similar levels of metabolizable energy on the other hand. The superior weight gain and efficiency of feed utilization of birds fed diets with the highest level of full-fat soyabean at the starter phase agrees with the previous study of Taiwo *et al.* (2005) who reported that full-fat soyabean has one of the best amino profile of all plant protein sources and therefore has the ability to support optimum performance of broiler chickens. In young, rapidly growing animals, protein is one of the most critical and indispensable nutrients needed for fast growth and body development (Abeke *et al.*, 2008). This could have been the case with the results of the present study with respect to the diet containing the highest level of full-fat soyabean supporting the highest weight gain.

The poor performance of birds fed the diet that contained equal proportions of maize and full-fat soyabean could have been due to the high fibre content. The high crude fibre content according to Babatunde *et al.* (1975) dilutes the energy content of the feed and therefore depresses the coefficient of digestibility of energy and protein with subsequent reduction in gain of monogastric animals. Similarly, high crude fibre in diets of monogastric animals also impedes mineral absorption (Nwokolo *et al.*, 1985).

On the basis of the results obtained, it may be recommended that either higher levels of maize or full-fat soyabean may be complementarily used as energy sources for broiler chickens without any adverse effect on their performance. This may be particular so when prices of each feed ingredients do not differ much.

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