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Address for Submission and all Editorial Correspondence: Dr. I. Charles Okoli, Tropical Animal Health and Production Research Lab, Department of Animal Science and Technology, Federal University of Technology PMB 1526, Owerri, Nigeria. Phone: 234-08053127006, 08054503660 Email: tapas-info@tapasinstitute.org, tapasinstitute@yahoo.com

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EFFECT OF ANAEROBIC FERMENTION/LYLE TREATMENT AND ROUSTING OF FLAMBOYANT (*DELONIX REGIA*) SEED ON NUTRIENT DIGESTIBILITY AND CARCASS CHARACTERISTICS OF BROILERS

S. S. A. Egena, S. K. Yahaya, E. L. Shiawoya and A. Usman
Department of Animal Production, Federal University of Technology Minna, Niger State, Nigeria
Corresponding author: S. S. A. Egena; E-mail: essa_may25@yahoo.com

ABSTRACT: *An experiment was conducted to evaluate nutrient digestibility and carcass characteristics of broilers following the replacement of groundnut cake (GNC) with anaerobically fermented/lyle treated flamboyant seed meal (AFLTFSM) and roasted flamboyant seed meal (RFSM) at the rate of 5% and 7.5%. One hundred and eighty day-old Hubbard broiler chicks were randomly allotted to six dietary treatments each with three replicates. The treatments were designated as T_1, T_2, T_3, T_4, T_5 and T_6. The experimental design used was the completely randomized design. Results showed that dry matter (DM), crude protein (CP), crude fiber (CF), ether extract (EE), ash and Nitrogen free extract (NFE) were significantly affected ($p<0.05$) by the treatments at both phases of the experiment. Apart from the DM and CP, all the other nutrients were poorly digested at the starter phase of the experiment, while there was an improvement in nutrient digestibility at the finisher phase. Live weight, slaughter weight, head, crop, intestine and lungs were also affected ($p<0.05$) by the treatment diets. It was concluded that anaerobically fermented/lyle treated flamboyant seed meal and roasted flamboyant seed meal has potential of being used as a feed ingredient in broiler production.*

Keywords: Chicken, broiler, flamboyant seed, anaerobic fermentation,

INTRODUCTION

Nigeria is blessed with a wide plethora of seed trees most of which are largely underutilized. Some of these trees might have once been used as a source of traditional human and animal diets (Grant *et al.,* 1991). However, attention is being drawn to some of these seed trees as possible alternative source of protein for poultry production, especially in the face of the increasing cost of raising poultry birds to market weight brought about by the high cost of the conventional feed sources. One of such seed tree is the flamboyant tree (*Delonix regia*); also known as flame of the forest. The tree is evenly spread in the country, where it is mostly used for ornamental purpose because of the beauty of its flowers when in season. It produces 25-40 cm long pods containing about 9-11 elongated seeds. Although of moderately high nitrogen content (Grant *et al.,* 1991), the seed contain lectin and other anti-nutrients, which might be deleterious to animals (Liener, 1986; 1989; Huisman *et al.,* 1989). These anti-nutritional factors need to be reduced or removed in order to render the seeds more useable for poultry feeding.

Work done using flamboyant seed meal (FSM) as the sole source of protein in rats diet showed that weight was maintained or gained during the experimental period and when used as part of the dietary protein, the rats grew rapidly (Grant *et al.,* 1991). Yusuf *et al.* (2004) in their work with broilers showed that when toasted, FSM can be used to replace soyabean meal (SBM) without any deleterious effect. Since FSM contains anti-nutrients, it is capable of affecting the digestibility of nutrients and carcass indices in birds. This is because feeding regime has been reported to affect meat quality (Lawrie, 1991; Okeudo and Moss, 2004; 2005).

This work evaluates the nutrient digestibility and carcass characteristics of broilers fed AFLTFSM and RFSM.

MATERIALS AND METHODS

Maize grain, maize offal, salt, fish meal, vitamin premix and GNC used for the experiment were all sourced from Minna. The test material (*Delonix regia*) abounds within Minna metropolis and its environment from where it was collected. It was further sun-dried and crushed in order to obtain the seeds. Some of the seeds were milled using a hammer mill and then, anaerobically fermented using the method described by (Annongu *et al.,* 2004). It was then dried in the sun and stored as anaerobically fermented/lyle treated flamboyant seed meal (AFLTFSM).

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Another batch of seeds was roasted in a pot over an open flame at the temperature of 100-105°C until the testa of the seed started splitting. They were then allowed to cool, milled and stored until needed as roasted flamboyant seed meal (RFSM). The two meals and the remaining milled untreated flamboyant seed meal (UFSM) were used in formulating six isonitrogenous and isocaloric diets designated as T_1 (control without FSM), T_2 (5% UFSM), T_3 (5% AFLTFSM), T_4 (5% RFSM), T_5 (7.5% AFLTFSM) and T_6 (7.5% RFSM) respectively (Table 1).

Table 1: Composition of experimental diets

Ingredients	Starter						Finisher					
	T_1	T_2	T_3	T_4	T_5	T_6	T_1	T_2	T_3	T_4	T_5	T_6
Maize	54.30	54.30	54.30	54.30	54.30	54.30	56.80	56.80	56.80	56.80	56.80	56.80
GNC	32.90	27.90	27.90	27.90	25.40	25.40	26.70	21.70	21.70	21.70	19.20	19.20
FSM	0.00	5.00	5.00	5.00	7.50	7.50	0.00	5.00	5.00	5.00	7.50	7.50
Maize bran	4.45	2.45	2.45	2.45	2.45	2.45	6.00	5.00	5.00	5.00	5.00	5.00
Fish meal	3.00	5.00	5.00	5.00	5.00	5.00	4.00	5.00	5.00	5.00	5.00	5.00
Limestone	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Bone meal	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Oil	3.00	3.00	3.00	3.00	3.00	3.00	4.00	4.00	4.00	4.00	4.00	4.00
Salt	0.10	0.10	0.10	0.10	0.10	0.10	0.25	0.25	0.25	0.25	0.25	0.25
Lysine	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Methionine	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Premix*	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Total	100	100	100	100	100	100	100	100	100	100	100	100
CP%	22.00	22.00	22.00	22.00	22.00	22.00	20.00	20.00	20.00	20.00	20.00	20.00
Energy(ME)	3,138	3,049	3,047	3,052	3,014	3,029	3,240	3,132	3,129	3,134	3,003	3007

*2.5 Kg of premix contains: Vitamin A (10000000iu), Vitamin D_3 (2000000iu), Vitamin E (12000iu), Vitamin K (2iu), Thiamine B (1.5g), Riboflavin B_2 (5g), Pyriboflavin B_6 (1.5g), Vitamin B_{12} (10mg), Biotin (20mg), Niacin (15g), Pantothenic acid (5g), Folic acid (0.6g), Manganese (75g), Zinc (50g), Iron (25g), Copper, Iodine (1g), Selenium (100mg), Cobalt (300mg), BHT (125g), Choline chloride (150g).

T_1 = 0% FSM; T_2 = 5% UFSM

T_3 = 5% AFLTFSM; T_4 = 5% RFSM

T_5 = 7.5% AFLTFSM; T_6 = 7.5% RFSM

One hundred and eighty (180) day-old Hubbard broiler chicks were randomly distributed to the six treatment diets, each with three replicates in a completely randomized experimental design. The birds were fed both starter and finisher ration. Feed and water were provided *ad libitum* and appropriate medication administered. The birds were kept on deep litter with wood shavings as litter material. The pens were electrically heated using 100 watt bulbs. The birds were raised over two phase of 5weeks starter period, followed up by another 3 weeks of finisher period. Overall the feeding trail lasted 8 weeks.

The test materials (AFLTFSM, RFSM and UFSM) were analyzed for cyanide, tannin and trypsin inhibitor activity by modifying the method of AOAC (1984). The phytate component was estimated by the method of Latta and Eskin (1984), while the chemical compositions of the experimental diets were analyzed as described by AOAC (1990).

Two birds from each treatment were randomly selected, slaughtered, bled and defeathered. These were used for carcass evaluation according to the method described by Esonu *et al.* (2006). Data collected were subjected to analysis of variance using MINITAB (2004) and means separated by the method of Duncan (1955).

RESULTS AND DISCUSSION

The effects of anaerobic fermentation/lyle treatment and roasting on the anti-nutritive content of flamboyant seed were presented in Table 2. It shows that both treatments have a positive reductive effect on phytate, cyanide, and trypsin inhibitor activity. The tannin content was however elevated as a result of the treatments.

The proximate composition of the UFSM, RFSM and AFLTFSM is presented in Table 3. The treatments given to the seed seemed to have concentrated the nutrients in them. This led to an increase in the DM, CP, CF and EE content of the seeds especially those roasted. A similar

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observation was reported by Udedibie *et al.* (1994) and Esonu (2001) concerning toasted Jackbean and Mucuna seeds respectively. AFLTFSM treated seeds had a lower content of NFE compared to the RFSM.

Table 2: Effect of anaerobic fermentation/lyle treatment and roasting on anti-nutritional factors of flamboyant seed meal

Parameters	UFSM	AFLTFSM	RFSM
Phytic acid (mg/100g)	503.10	238.50	469.00
Tannin (g/Kg)	22.64	28.11	23.44
Cyanide (mg/100g)	18.07	14.75	10.50
Trypsin inhibitor activity (mg/g)	36.85	19.42	14.09

Table 3: Effect of anaerobic fermentation/lyle treatment and roasting on proximate composition of flamboyant seed meal (%)

Parameters	UFSM	AFLTFSM	RFSM
DM	81.80	87.10	89.40
CP	18.10	18.10	18.90
CF	7.50	11.00	11.00
EE	7.50	7.50	9.00
Ash	3.60	3.60	3.40
NFE	45.10	46.90	47.10

This might be due to leaching of the carbohydrate component of the seed as a result of the prolonged period of soaking, fermentation and the lyle treatment to which the seeds were exposed to during processing. The increase in EE of the roasted seeds is a pointer that roasting increase crude fat a fact attested to by Okigbo (1975).

Table 4 represents the apparent nutrient digestibility by broilers fed RFSM and AFLTFSM based diets at the starter and finisher phases of the experiment. Apart from the DM and CP, all the other nutrients were poorly digested at the starter phase of the experiment. This might be attributed to the age of the birds and the relatively high fiber content of the test material (Table 3). The higher the CF level of feed, the more easily and quickly it will pass through the gastrointestinal tract of birds and this reduces the contact time between the nutrients inherent in the diet and digestive enzymes. This has the tendency to lower nutrient digestibility.

Table 4: Effect of anaerobic fermentation/lyle treatment and roasting on apparent nutrient digestibility in broilers fed flamboyant seed meal (%)

Parameters	T_1	T_2	T_3	T_4	T_5	T_6	StDev
Starter phase							
DM	73.95^{a}	78.86^{c}	78.35^{c}	78.91^{c}	77.45^{b}	77.04^{b}	1.25*
CP	69.60^{a}	81.45^{c}	78.47^{b}	80.10^{c}	79.62^{b}	79.05^{b}	2.15*
CF	40.91^{a}	44.52^{c}	44.95^{c}	44.50^{c}	43.65^{b}	43.85^{b}	1.48*
EE	33.30^{a}	48.12^{c}	47.30^{c}	45.58^{b}	44.76^{b}	46.18^{b}	2.14*
Ash	37.38^{a}	48.95^{b}	51.29^{c}	47.39^{b}	45.78^{b}	46.34^{b}	3.64*
NFE	43.26^{a}	48.86^{b}	54.30^{c}	49.46^{b}	47.77^{b}	50.76^{c}	4.50*
Finisher phase							
DM	75.33^{a}	81.00^{c}	82.50^{c}	81.00^{c}	76.50^{b}	76.00^{b}	2.85*
CP	79.50^{a}	91.39^{d}	88.65^{c}	89.84^{c}	87.39^{c}	84.06^{b}	2.84*
CF	85.13^{b}	92.81^{c}	92.80^{c}	91.87^{c}	85.17^{b}	83.62^{a}	4.19*
EE	62.23^{a}	82.07^{c}	77.12^{b}	86.50^{d}	71.50^{b}	81.00^{c}	2.47*
Ash	75.01^{a}	76.38^{a}	82.41^{b}	86.70^{c}	83.33^{b}	75.95^{a}	3.93*
NFE	68.50^{a}	82.50^{bc}	81.00^{bc}	86.50^{c}	75.50^{b}	80.00^{bc}	3.65*

Means denoted by different superscript along the same row are significantly different ($p<0.05$).

*Legend: As in table 1

The CF values were higher than the 5% recommended for starter broiler (Oluyemi and Roberts, 1979). Lignin content of fiber, which is largely indigestible, also lowers the digestibility of cellulose, complex carbohydrate and other nutrients (Jokthan *et al.*, 2006).

There was an improvement in nutrient digestibility at the finisher phase of the experiment. This might be as a result of the birds being older and being better able to tolerate the test material and

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its high fiber content. The high digestibility coefficients exhibited by birds especially for DM and CP at both phases of the experiment is in line with the reports of Jaffe (1975) that processing of legume seeds lead to improvement in DM digestibility and protein quality. Good protein quality renders protein more digestible. The birds were better ($p<0.05$) able to digest the diets containing flamboyant seed than the control diet, which is an indication that flamboyant seed could effectively be used to replace GNC in broiler diets. Comparable digestibility values were also observed between the UFSM, RFSM and AFLTFSM. This is an indication that broilers can utilize meals containing flamboyant seed be it in its untreated or treated form. Grant *et al.* (1991) had earlier reported that Flamboyant seed is one of the well utilized legume seeds.

Table 5 represents the cut-up parts of the carcass expressed as percentage of live weight at slaughter. The shank, thigh, drumstick, back, breast and wing values of birds fed flamboyant seed meal based diets were not significantly different ($p>0.05$) from those of the control an indication that the effect of anti-nutrients in the seed is less pronounced on the birds. The head and neck were however significantly ($p<0.05$) increased particularly in birds fed 5% AFLTFSM and the UFSM. The neck and head are non-economic parts of the carcass. All the cut-up parts were reflections of the live weights at slaughter. This shows that feed components play a very vital role on the final weight of the body parts of poultry birds.

Table 5: Effect of anaerobic fermentation/lyle treatment and roasting on cut-up parts of broilers fed flamboyant seed meal (%)

Parameters	T_1	T_2	T_3	T_4	T_5	T_6	StDev
Live weight(g)	1,465^a	1,700^c	1,485^a	1,709^c	1,643^b	1,645^b	199.90*
Slau*. weight	97.95^c	96.09^c	96.77^c	97.25^c	89.17^a	93.01^b	155.10*
Head	2.82^{bc}	2.90^{bc}	4.05^c	2.49^b	2.25^a	2.46^a	0.97*
Neck	5.80	6.19	8.95	6.14	5.63	5.90	2.43ns
Shank	5.48	4.96	4.86	5.13	4.63	5.13	0.61ns
Thigh	10.05	11.54	11.45	11.66	11.03	11.13	2.94ns
Drumstick	10.35	9.76	9.95	10.35	9.79	10.74	1.87ns
Back	10.51	11.44	10.78	12.01	10.42	11.50	3.19ns
Breast	11.84	11.71	15.99	14.37	14.40	14.70	4.92ns
Wing	11.37	11.48	12.02	12.21	11.09	12.44	2.75ns

Means denoted by different superscript along the same row are significantly different ($p<0.05$).
ns: not significant ($p>0.05$).
*slaughter weight.
Legend: As in table 1

Table 6 shows the internal organ percentages of the birds. The weight of the lungs, heart and crop of birds fed flamboyant seed meal based diets were consistently higher than those fed the control diet. The intestine of the birds fed the control diet was somewhat greater in weight than those fed the flamboyant seed meal based diets although insignificantly ($p>0.05$). Perhaps the digestible nature of the flamboyant seed meal based diets did not warrant further growth of the intestine in order to facilitate better digestion and absorption of nutrients.

Table 6: Effect of anaerobic fermentation/lyle treatment and roasting on internal organs of broilers fed flamboyant seed meal (%).

Parameters	T_1	T_2	T_3	T_4	T_5	T_6	StDev
Crop	1.05^a	3.01^c	2.36^b	1.26^a	1.94^b	4.86^d	1.67*
Gizzard	5.01	3.64	6.08	4.63	4.01	4.50	1.90ns
Intestine	8.44^d	6.14^a	6.95^c	6.24^a	6.26^a	6.34^b	1.28*
Heart	0.47	0.53	0.54	0.54	0.43	0.41	0.11ns
Lungs	0.50^a	0.54^a	0.62^b	0.72^c	0.60^b	0.65^b	0.14*
Kidney	0.19	0.15	0.17	0.17	0.18	0.21	0.06ns
Liver	2.16	1.98	2.23	2.20	1.90	1.98	0.32ns

Means denoted by different superscript along the same row are significantly different ($p<0.05$).
ns: not significant ($p>0.05$).
Legend: As in table 1

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CONCLUSION

Flamboyant seed is a potential feed ingredient for broiler feeding as it is well tolerated both in its untreated and treated forms. Researching into other methods of processing the seed will further throw more light on its nutritive relevance and possible adoption by poultry farmers.

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