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EFFECTS OF ANAEROBIC FERMENTATION AND LYLE TREATMENT OF *Delonix regia* SEED MEAL ON PERFORMANCE OF FINISHER BROILERS

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ABSTRACT

An experiment was conducted using 120 day-old Hubbard broiler birds to evaluate the effects of anaerobic fermentation and lyle treatment of *Delonix regia* seed meal on the performance of finisher broilers. Four treatment diets designated T_1, T_2, T_3 and T_4 were compounded with T_1 representing 0% anaerobically fermented and lyle treated Delonix seed meal, T_2 represents 5% untreated raw Delonix seed meal, while T_3 and T_4 represent 5% and 7.5% anaerobically fermented and lyle treated Delonix seed meal respectively. Experimental design used was the completely randomized design. Results showed that the treatments did not significantly ($p>0.05$) affect body weight and feed conversion ratio but significantly ($p<0.05$) affected feed intake and body weight gain. Dry matter, crude fiber and ash digestibility were not significantly affected ($p>0.05$), while crude protein, ether extract and Nitrogen Free Extract digestibility were affected ($p<0.05$) by the treatment diets. The inclusion of anaerobically fermented and lyle treated *Delonix regia* seed meal in the diet affected ($p<0.05$) the head, crop, intestine and the lungs, while the neck, gizzard, heart, kidney, liver, thigh, drumstick, back, breast and wing were not affected ($p>0.05$) significantly. It was concluded that anaerobic fermentation followed by lyle treatment of *Delonix regia* seed meal makes it suitable for use as a substitute for groundnut cake in finisher broiler diet.

Keywords: *Delonix* seed meal, finisher broilers, lyle treatment, anaerobic fermentation

INTRODUCTION

Research effort in Nigeria as in other developing countries is being focused on alternative sources of feed ingredients. This is a fall out of the increase in population growth, decline in the production of grains (cereals and legumes) the major source of energy and protein, competition between livestock, man and the industry as well as an increase in the production of livestock particularly poultry. Poultry here refers to the domestic fowl, turkey, duck, geese and guinea fowl, pigeon, partridge, ostrich and other game birds which according to Babatunde (1980) hold the key to overcoming the protein insufficiency inherent in the population. This is because of their short gestation period (Abdullahi *et al*., 2002), making it possible for them to turn over feed into useful eggs and meat within a relatively short time. Rearing these birds to market weight however has become a major constraint due to the escalating cost of conventional feedstuff. It has been reported that feed cost alone account for 70-80% of the total cost of producing table birds (Akinmutimi, 2006).

It is in an effort to reduce the cost of rearing poultry birds that research is being focused on non conventional feed resources. The potential of these non-conventional ingredients lies in their comparable nutrient composition, ease of collection and relative cheapness. Most of them particularly those of legume origin however need to be processed as their seeds often contain anti nutritional factors such as lectins (Cheeke and Shull, 1985; Liener, 1989) and other anti-nutrients (Iyayi and Egharevba, 1998; Emiola *et al*., 2003).

The use of raw legumes in the diets of animals as sole protein source has been reported to lead to significant reduction in performances and other undesirable physiological alterations (Carew *et al*., 2003). Hence the need to process them before use as animal feedstuff. *Delonix regia* is a tropical and sub-tropical deciduous flowering plant, commonly known as Flame of the forest. It grows extensively all over Nigeria, where it is used mostly for ornamental purpose. Its flowers when in season are a delight to behold. Our interest however is on the seeds contained in elongated pods and arranged lengthwise (Keay, 1989). Although of moderately high N content (Grant *et al*., 1991) and widely available, they are not utilized as feedstuff. Their relative abundance and high N content ignited the interest of the authors.

This work therefore was carried out to evaluate the effects of anaerobic fermentation and lyle treatment of *Delonix* seed meal on the performance of finisher broilers.

MATERIALS AND METHODS

Location of study: The study was carried out at the poultry unit of the Department of Animal Production, School of Agriculture and Agricultural Technology of the Federal University of Technology, Minna, Niger state, Nigeria. Minna is situated on longitude 6° 33' east and latitude 9° 45' north of the equator. Minna experiences two distinct seasons (dry and wet) with an annual precipitation varying from 1,100-1,600mm and a mean temperature of 36.5° C between March and June and 21° C between December and January.

Processing of *Delonix regia* and experimental diets: *Delonix* seeds were collected during the dry season, within and around Minna environment. Some portion of the collected seeds was anaerobically fermented and then treated with lyle solution using an adaptation of the method described by Annongu *et al.* (2004). This involved milling the seeds in a hammer mill with sieve size of 3 mm. The milled seeds were then soaked in a given quantity of tap water for 7 days after which the dough was removed and packed in double layered polythene bags and tied to exclude air. It was then placed in a drum, covered to make it air-tight, and left to ferment for another 7 days.

After this, the dough was soaked in lyle solution (constituted by dissolving 20 Kg of ash in 100 liters of water) for 2 days. It was then strained, sun-dried and stored until further use as anaerobically fermented and lyle treated *Delonix* seed meal (AFLTDSM). Some quantity of the collected seeds was left untreated. This was sun-dried and milled using the same hammer mill and stored until further use as untreated raw *Delonix* seed meal (URDSM).

Four broiler finisher diets were formulated using *Delonix* seed meal (Table 1) and fed to the birds at the finisher phase. The formulated diets were: T_1 = 0% inclusion of *Delonix* seed meal (control); T_2 = 5% inclusion of URDSM; T_3 = 5% inclusion of AFLTDSM; T_4 = 7.5% inclusion of AFLTDSM. The diets were formulated to be isonitrogenous and isocaloric to meet the protein and energy requirements of finisher broilers.

Table 1: Composition of experimental diets

	Diets			
Ingredients	T_1	T_2	T_3	T_4
Maize	56.70	56.70	56.70	56.70
GNC	26.70	21.70	21.70	21.70
URDSM	0.00	5.00	0.00	0.00
AFLTDSM	0.00	0.00	5.00	7.50
Maize bran	6.00	5.00	5.00	5.00
Fish meal	4.00	5.00	5.00	5.00
Bone meal	0.80	0.80	0.80	0.80
Limestone	1.00	1.00	1.00	1.00
Palm oil	4.00	4.00	4.00	4.00
Salt	0.25	0.25	0.25	0.25
Lysine	0.10	0.10	0.10	0.10
Methionine	0.10	0.10	0.10	0.10
Premix*	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00
%CP	20.00	20.00	20.00	20.00
ME (Kcal/Kg)	3200.00	3132.00	3129.00	3003.00
Chemical composition (%)				
DM	81.30	84.20	85.70	85.20
CP	20.60	20.00	19.90	19.70
CF	5.50	5.00	4.00	6.00
EE	19.60	23.30	22.00	21.35
Ash	4.40	4.96	6.40	4.92
NFE	31.80	30.74	33.40	33.23

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

Experimental birds and their management: A total of 120 day old Hubbard broiler birds were acquired and used for the experiment. The birds on arrival were randomly distributed into four treatment groups of three replicates representing thirty birds/treatment and ten birds/replicate. The poultry house was washed and disinfected before the arrival of the birds. The birds were housed in pens covered with wood shavings as litter material and heated electrically throughout the experimental period with 100 watt bulbs. Supplemental heat was provided from charcoal drums. The birds were fed and watered *ad libitum*. They were also vaccinated against Newcastle and Gumboro diseases, the common poultry diseases in the study area. Vitalyte® was given as anti stress whenever operations such as vaccination and weighing were carried out. A coccidiostat was also administered weekly through water as a preventive measure. Other routine management practices were also observed. The birds were raised on standard commercial broiler starter diet for the first four weeks before they were changed to the treatment diets.

Chemical analysis: The nutrient content of the diets, proximate composition of the raw untreated and processed *Delonix regia* seed meals were determined according to the procedure of AOAC (1990). Cynogenic content, tannins and trypsin inhibitor activity (TIA) were analyzed by modifying the procedure of AOAC (1984). Phytic acid was determined by the method of Latta and Eskin (1980).

Digestibility trial: A digestibility trial was conducted according to the method adopted by Annongu *et al.* (2004) in order to ascertain the level of nutrient utilization by the birds. The parameters determined were dry matter (DM), crude protein (CP), crude fiber (CF), ether extract (EE), ash and Nitrogen free extract (NFE).

Statistical analysis: All data collected were subjected to one-way analyses of variance (ANOVA) using SPSS (2001). Where statistical differences were observed, Means were separated using Duncan Multiple Range Test (Duncan, 1955).

RESULTS AND DISCUSSION

The results of the quantitative determination of phytic acid, tannin, cyanide and trypsin inhibition activity (TIA) in raw and processed *Delonix regia* seed meal (Table 2) revealed that processing led to decrease in phytic acid, cyanide and TIA. Tannin was however elevated. Tannins are reported to have adverse effects as they in part act as trypsin inhibitors due to their high biological activity (Belitz and Weder, 1990). A result of such biological activity is reduction in feed intake (Bate-smith, 1981). Tannins also form complex linkages with protein, with the attendant problem of loss of protein and amino acid resulting in poor growth (Akinmutimi, 2006).

Table 2: Effect of anaerobic fermentation and lyle treatment on anti-nutritional factors in *Delonix* seed meal

Parameters	URDSM	AFLTDSM
Phytic acid (mg/100g)	503.10	238.50
(% decrease in phytic acid)	----	52.59
Cyanide (mg/100g)	18.07	14.75
(% decrease in cyanide)	----	18.37
TIA (mg/g)	36.85	19.42
(% decrease in TIA)	----	47.30
Tannin (g/Kg)	22.64	28.11
(% increase in tannin)	----	24.16

Cyanide content was reduced as a result of anaerobic fermentation and lyle treatment of the seeds. The lower value of cyanide in the processed *Delonix regia* seed meal implies that less methionine may be needed for detoxification when used to formulate ration. Lower cyanide level will allow for better growth (Aletor and Fasuyi, 1997).

Anaerobic fermentation followed by lyle treatment equally led to a reduced TIA. A reduction in inhibition of trypsin enzyme means that protein digestion will not be seriously hampered or impaired when the processed *Delonix regia* seed meal is fed to broilers. Akinmutimi (2006) is of the opinion that where TIA is reduced, the problem of pancreatic hypertrophy due to trypsin inhibition may be avoided.

The reduction in phytic acid following processing is a positive occurence. This is because phosphorus component of the diets formulated using *Delonix regia* seed meal will be available for usage by the birds. Phosphorus plays a very important role in series of biochemical reactions in the body (Cromwell, 1989) particularly those related to energy mobilization and usage.

The chemical composition of the raw untreated and anaerobically fermented and lyle treated *Delonix regia* seed meal was presented in table 3. While dry matter, crude protein, crude fiber, ether extract and ash were reduced as a result of processing, the nitrogen free extract level was increased. This increase confers a higher energy value to the feed stuff. The reduction in the level of crude protein, crude fiber, ether extract and ash might be as a result of the seeping out of these nutrients due to the prolonged period of soaking of the milled *Delonix regia* seeds.

Table 3: Proximate composition of *Delonix* seed meal (%)

Parameters	URDSM	AFLTDSM
Dry matter	87.90	87.13
Crude protein	18.40	18.10
Crude fiber	17.00	11.00
Ether extract	9.50	7.50
Ash	8.60	3.60
Nitrogen free extract	34.40	46.93

Table 4 showed the performance of broilers fed anaerobically fermented and lyle treated *Delonix regia* seed meal. It showed that feed consumption, body weight gain and feed conversion ratio were all significantly ($p<0.05$) affected. Feed intake was increased in birds fed *Delonix regia* seed meal based diets compared to those fed the control diet. Body weight gain also followed the same trend resulting in better final body weights for birds fed the anaerobically fermented and lyle treated *Delonix regia* seed meal. Bogart and Taylor (1983) reported that growth is a function of feed consumption and that weight gain is positively related to feed consumed over that needed for maintenance purposes.

Table 4: Performance of finisher broilers fed *Delonix* seed meal based diets

	Diets				
Parameters	T_1	T_2	T_3	T_4	StDEV
Initial body weight (g)	312.86	326.50	310.10	312.80	
Av. Body weight (g)	1506.90	1543.50	1595.70	1545.43	376.46ns
Av. Feed intake (g)	740.10	920.80	946.00	940.70	171.12*
Body weight gain (g/week)	210.08	282.93	308.55	308.03	96.80*
Feed conversion ratio	4.12	3.04	3.68	3.23	1.50*
Protein efficiency ratio	1.38	1.74	1.50	1.66	
Energy efficiency	9.35	7.95	8.92	7.86	

The higher final body weights observed for birds fed *Delonix regia* seed meal based diets is an indication that broilers can tolerate the anti-nutrients present in the seed meal including the raw untreated meal. The final body weights obtained in this study is however lower that that reported by Yusuf *et al.* (2004), when they fed toasted flamboyant seed meal to broilers. This might be due to the different breed of birds used in the two studies.

Table 5 showed the degree of nutrient utilization by broilers fed anaerobically fermented and lyle treated *Delonix regia* seed meal. All the nutrient components were well digested by the birds.

Table 5: Apparent nutrient digestibility by finisher broilers fed *Delonix* seed meal based diets (%)

	Diets				
Parameters	T_1	T_2	T_3	T_4	StDEV
Dry matter	75.32^b	81.00^a	82.50^a	76.50^b	3.79*
Crude protein	79.80^c	91.39^a	88.65^b	87.39^b	5.08*
Crude fiber	85.13	92.81	92.80	85.17	5.47ns
Ether extract	62.23^c	82.06^a	77.12^b	71.50^b	8.15*
Ash	75.01^b	76.38^b	82.41^a	83.32^a	4.79*
Nitrogen free extract	68.50^c	82.50^a	81.00^a	75.50^b	6.31*

This might be because the birds were older and being older, were better able to tolerate the test material and its high fiber content. The fact that better nutrient digestibility was recorded for birds fed *Delonix regia* seed meal based diets signify that it can be used to replace groundnut cake in broilers diets. The high digestibility coefficients observed for birds fed diets 3 and 4 compared to those fed the control diet is an indication that processing of legume seeds leads to improvement in their digestibility by broilers. The improvement observed in crude protein digestibility in birds fed

anaerobically fermented and lyle treated *Delonix regia* seed meal based diets might be as a result of the inactivation of TIA. TIA is reported to delay protein digestion (Sathvamoorthy *et al.*, 1981; Norton *et al.*, 1985). This is achieved by inhibiting trypsin and chymotrypsin activities and by forming an enzyme-inhibitor complex (Gallagher and Schneeman, 1986). Such a complex will most likely impair protein digestion and hence the efficiency of protein metabolism and absorption into the body.

Tables 6a and 6b showed the effects of feeding *Delonix regia* seed meal following anaerobic fermentation and lyle treatment on the internal organs and cut-up parts of the birds. The crop and lungs were significantly increased ($p<0.05$) in birds fed the treated meals. The increase in the weight of the crop might be due to expansion since these birds were observed to have consumed more than those fed the control diet. The head was significantly increased ($p<0.05$) as a result of the substitution of groundnut cake with the treated *Delonix* seed meal. The head however is not an economic portion of the carcass as it ranks very low with consumers.

Table 6a: Effect of feeding anaerobically fermented and lyle treated *Delonix seed* meal on internal organs of finisher broilers (% of live weight)

Parameters	T_1	T_2	T_3	T_4	StDEV
Crop	1.05^d	3.01^a	2.36^b	1.94^c	1.67*
Gizzard	5.01	3.64	6.08	4.01	1.90ns
Intestine	8.44^a	6.14^c	6.95^b	6.26^c	1.28*
Heart	0.47	0.53	0.54	0.43	0.11ns
Lung	0.50^b	0.54^b	0.62^a	0.60^a	0.14*
Kidney	0.19	0.15	0.17	0.18	0.06ns
Liver	2.16	1.98	2.23	1.90	0.32ns

Table 6b: Effect of feeding anaerobically fermented and lyle treated *Delonix* seed meal on cut-up parts of finisher broilers (% of live weight)

Parameters	T_1	T_2	T_3	T_4	StDEV
Head	2.82^b	2.90^b	4.05^a	2.25^c	0.97*
Neck	5.80	6.19	8.95	5.63	2.43ns
Thigh	10.05	11.54	11.45	11.03	2.94ns
Drumstick	10.35	9.76	9.95	9.79	1.87ns
Back	10.51	11.44	10.78	10.42	3.19ns
Breast	14.84	11.71	15.99	14.40	4.92ns
Wing	12.37	11.48	12.02	11.09	2.75ns

CONCLUSION

From these results it was concluded that anaerobic fermentation followed by lyle treatment of *Delonix regia* seed meal makes it suitable for use as a substitute for groundnut cake in finisher broiler diet.

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