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Performance of Starter Broilers Fed Anaerobically Fermented and Lyle Treated *Delonix regia* Seed Meal

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Abstract: One hundred and twenty day-old Hubbard broiler birds were used to study the effects of anaerobic fermentation and lyle treatment of *Delonix* seed meal on the performance of starter broilers. The experimental period spanned 5 weeks. The birds were divided into four treatment groups of three replicates each using complete randomized design. The anaerobically fermented and lyle treated *Delonix* seed meal (AFLTDSM) was used to replace groundnut cake (GNC) at 0%, 5% and 7.5% level. Untreated raw *Delonix* seed meal (URDSM) was also used at 5% level in order to evaluate its effects on starter broiler performance. The four treatments were designated as T_1, T_2, T_3 and T_4 respectively. Parameters evaluated were mean body weight, daily body weight gain, mean feed intake, mean feed conversion ratio as well as apparent nutrient digestibility. The results showed that mean body weight, daily body weight gain, mean feed intake and mean feed conversion ratio were not significantly affected ($p>0.05$) by the substitution of GNC with AFLTDSM in the diets. However, apparent nutrient digestibility of dry matter (DM), crude protein (CP), ash, ether extract (EE) and Nitrogen free extract (NFE) were significantly affected ($p<0.05$) by the treatment diets. Crude fibre (CF) digestibility was however not affected ($p>0.05$) by the inclusion of *Delonix* seed meal in the diets. It was concluded that AFLTDSM could be used as a substitute for GNC in starter broilers diet without any significant effect on the performance of the birds.

Key words: Performance, starter broilers, anaerobic fermentation, *delonix* and lyle treated

Introduction

Food security has become a major concern in Africa and most of the developing countries due to rapid population growth. According to Gueye (2007), the total mid-year African human population in 2004 was estimated to be 871 million people. This rapid growth is characterized by increasing pressure on biological resources used for the production of food. A fall out of this increase in population is competition between man, the industry and livestock reared to serve as a source of protein needed by the teeming population. In order to be able to provide protein in quantity and quality, there is the need to accelerate the production of livestock generally and poultry in particular.

The rearing of poultry birds either locally which represents more than 80% of the total poultry production in Africa (Gueye, 2000) or commercially appears to be a way out of meeting the need occasioned by the rapid growth in population. With a total poultry population of 1, 356 million chickens, 16 million ducks, 12 million geese and guinea fowls and 9 million turkeys, producing 2, 180, 125 metric tones (MT) of hen eggs, 7, 143 MT of other poultry eggs, 3, 257, 292 MT of chicken meat, 56, 619 MT of duck meat, 55, 340 MT of goose and guinea fowl meat and 66, 252 MT of turkey meat (FAO Aide News, 2007) a solution seems to be around the corner for overcoming the protein deficit apparent in African human population. These birds however need to eat in order to grow, maintain themselves and produce the needed eggs and meat of biological value.

This is where the problem is as most feed ingredients, particularly those of protein and energy origins, are quite expensive and also scarce due to competition for them. The recent drive for alternative energy (ethanol from maize and cassava) should therefore be seen as a great threat to the livestock industry and poultry production in particular. The beacon is therefore now on alternative sources of feed otherwise known as non-conventional feedstuff. These non-conventional feedstuffs are mostly not competed for by man and animals and hence represent a great potential as cheaper and readily available feed resources. There abound in Africa a lot of tree legumes whose seeds can be harvested and incorporated into poultry and other monogastric animal feed.

This study was undertaken therefore to evaluate one of such non-conventional protein source (*Delonix* seed meal) and its effect on the performance of starter broiler birds. The tree plant grows extensively in most African countries where it is used for beautification because of its aesthetic flowers when in season. The seeds are not used as food by man and can easily be collected from the tree during the dry season. Hence it is cheap.

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). It involved milling the seeds using a hammer mill with sieve size of 3mm. 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 20Kg 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 other portion of the collected seeds was left untreated. This was sun-dried and milled using the same hammer mill as above and stored until further use as untreated raw *Delonix* seed meal (URDSM).

Four different diets were formulated using *Delonix* seed meal (Table 1) and fed to the birds. 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 starter broilers.

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 100watt bulbs. The birds were fed and watered *ad libitum*. They were also vaccinated against Newcastle and Gumboro diseases, the common poultry diseases in the area. Vitalyte® was given as anti-stress whenever operations such as vaccination and weighing were carried out. Coccidiostat was also administered weekly through water as a preventive measure. Other routine management practices were also observed.

Table 1: Composition of experimental diets

	Diets			
Ingredients	T_1	T_2	T_3	T_4
Maize	54.30	54.30	54.30	54.30
GNC	32.90	27.90	27.90	25.40
URDSM	0.00	5.00	0.00	0.00
AFLTDSM	0.00	0.00	5.00	7.50
Maize bran	4.45	2.45	2.45	2.45
Fish meal	3.00	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	3.00	3.00	3.00	3.00
Salt	0.10	0.10	0.10	0.10
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	22.00	22.00	22.00	22.00
ME (Kcal/Kg)	3138.00	3049.00	3047.00	3014.00
Chemical composition (%)				
DM	77.20	80.00	81.00	85.80
CP	23.00	22.75	22.75	22.75
CF	3.30	4.60	3.61	5.60
EE	20.00	17.50	17.50	19.00
Ash	5.40	4.80	5.40	4.80
NFE	25.50	30.35	32.74	33.65

*2.5Kg 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% 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.

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

Digestibility trial: A digestibility trial was conducted in order to ascertain the level of nutrient usage by the birds. The parameters determined were DM, CP, CF, EE, ash and NFE. This was done by the method of AOAC (1990).

Statistic: All data collected were subjected to one-way analyses of variance (ANOVA) using SPSS (2001). Where statistical differences were observed, means were separated using the method of Duncan (1955).

Results and Discussion

Table 2 represents the proximate composition of *Delonix* seed meal both in its untreated raw and processed forms. The processing slightly led to a decrease in DM and CP of the test material. However, the CF, EE and ash content were greatly reduced as a result of the anaerobic fermentation and lyle treatment to which the *Delonix* seeds were exposed. The decreases might be due to leaching out of nutrients as a result of

Table 2: Proximate composition of Delonix seed meal (%)

Parameters	URDSM	AFLTDSM
DM	87.90	87.13
CP	18.40	18.10
CF	17.00	11.00
EE	9.50	7.50
Ash	8.60	3.60
NFE	34.40	46.93

Table 3: 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

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

	Diets				
Parameters	T_1	T_2	T_3	T_4	SEM
Initial body weight (g)	60.30	60.36	61.20	60.00	
Av. Body weight (g)	282.89	292.38	312.92	300.16	20.93^{ns}
Av. Feed intake (g)	285.45	386.45	381.47	394.05	18.96^{ns}
Daily body weight gain(g)	13.45	14.93	13.78	13.77	5.35^{ns}
Feed conversion ratio	4.34	4.31	3.34	3.70	0.18^{ns}
Protein efficiency ratio	1.41	4.40	4.34	4.48	
Energy efficiency	7.84	9.58	10.36	10.65	

ns = not significant (p>0.05). 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.

prolonged soaking during processing. Akinmutimi (2006) reported similar decrease in CP content in *Mucuna pruriens* following cooking for 90 minutes.

Table 3 shows the effect of anaerobic fermentation and lyle treatment on anti-nutritional factors present in *Delonix* seed meal. The processing greatly led to a reduction in phytic acid, cyanide and TIA. This is a positive occurrence as these anti-nutritional factors have been reported to limit the utilization of seeds containing them (Wu and Inglett, 1974) and particularly in broilers, where they have been reported to reduce growth rate due to reduced protein and specific amino acid utilization (Douglas *et al.,* 1992; Elkin *et al.,* 1995). The tannin content was however increased following treatment. Tannins have been reported to be resistant to treatment such as cooking (Akinmutimi, 2004). It is possible that due to the removal of moisture during processing, the tannin content became more concentrated in the seed meal hence the increase in tannin content.

The performance of broilers fed AFLTDSM is shown in Table 4. The inclusion of AFLTDSM in the diet resulted in marked growth differences with broilers on the raw untreated *Delonix* seed meal having the least average body weight compared to those on the treated diets. The daily weight gain of the birds fed the raw untreated *Delonix* seed meal was however higher than for the birds fed the treated diets and the control although not significantly (p>0.05). This disagrees with the findings of Olupona *et al.* (1999) and Amaefule and Obioha (2001) who observed poorer weight gains in monogastric animals fed raw legume seeds. Perhaps this is because *Delonix* seed meal is well utilized by poultry birds. This is in consonant with the findings of Grant *et al.* (1991) that *Delonix* seeds are among those fringe legume seeds well utilized by animals.

Feed intake was better in birds fed the *Delonix* seed meal based diets compared to those fed the control diet. This might be due to the increasing level of fibre in the diet (Table 1) particularly in diets 2 and 4. High fibre in the diet meant that in order for the birds fed these diets to meet their requirements for energy, protein and other dietary components, the birds had to eat more. This agrees with the report of Savory and Gentle (1976) and Abdelsamie *et al.* (1983).

Feed conversion ratio was better in birds fed AFLTDSM. This might be due to the effect of fermentation which has been reported to improve nutrient density, digestibility as well as control anti-nutrients and toxins (Hamad and Field, 1978).

Protein efficiency ratio increased with increasing level of AFLTDSM in the diet. This might not be too surprising as fermentation improves nutrient digestibility as reported above. The implication is that the efficiency of protein utilization will be enhanced. Besides, the reduction in TIA in the treated meal means protein digestion will be improved in diets containing them. Norton *et al.* (1985) reported that trypsin inhibitor delay protein digestion. This could be through the inhibition of trypsin and chymotrypsin, enzymes necessary for protein digestion in the gastro-intestinal tract of the birds.

The estimates of apparent nutrient utilization are shown in Table 5. It revealed that the inclusion of AFLTDSM in the diets significantly (p<0.05) affected DM, CP, EE, ash and NFE digestibility by the birds. With the exception of DM and CP, all the other nutrients were poorly digested. This might not be unconnected with the age of the birds and the length of time it took the birds to get acclimatized to the test material. The high digestibility values observed for DM and CP in this study is in agreement with the report of Jaffe (1975) which stated that processing of legume seeds leads to improvement in DM and protein quality.

The high fibre content of *Delonix* seed meal (Table 2) could be faulted for the low digestibility values observed for CF, EE, ash and NFE. This is because it decreased the exposure time of these nutrients to digestive enzymes due to increased rate of passage through the gastro-intestinal tract induced by fibre. High fibre diet is known to aid quick bowel movement. This according to Trait and Wright (1990), decreases the availability of

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

	Diets				
Parameters	T_1	T_2	T_3	T_4	SEM
DM	78.95^a	78.90^a	78.35	75.95^b	0.76^*
CP	69.60^c	76.47^b	81.45^a	79.62^b	1.84^*
CF	40.91	44.52	44.95	43.65	0.73^{ns}
EE	33.30^c	48.12^a	47.29^a	44.76^b	2.28^*
Ash	37.38^c	48.95^b	51.28^a	45.78^b	2.61^*
NFE	43.26^c	48.86^b	54.29^a	47.76^b	1.80^*

ns = not significant ($p>0.05$). Means denoted by different superscripts are significantly different ($p<0.05$). 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.

nutrients. This eventually will affect growth in birds as most of the nutrients will be lost via the faeces. Onifade and Babatunde (1997) reported the interference of high fibre with nutrient availability at the tissue level. According to them, this reduces nutrient available for growth and maintenance. This probably affected the average daily body weight gain and by implication, the average body weight of the birds at five weeks.

Conclusion: The result of this study indicates that AFLTDSM could be used as a substitute for GNC in starter broilers diet without any serious effect on the performance of the birds. Effort should be geared therefore on finding other means of processing the seeds in order to render them more useful and useable as a protein source for poultry and other monogastric animals.

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