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Effects of feeding graded levels of African Locust Bean (*Parkia biglobosa*) pulp on growth performance, carcass and haematological parameters of growing rabbits

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Target Audience: *Farmers, Researchers, Policy makers*

Abstract

Twenty-four (24) unsexed mixed breed grower rabbits weighing between 500-571g were used in a feeding trial for ten (10) weeks. The experiment was conducted at the Teaching and Research Farm, Department of Animal Science, Modibbo Adama University of Technology Yola. The rabbits were assigned to four dietary treatments replicated three times with two animals per replicate in a complete randomize design. The treatment diets contained varying levels of African locust bean pulp (ALBP) as Treatments 1 (0%), 2(10%), 3(20%) and 4(30%) respectively. Significant (P< 0.05) differences were recorded in Final weight, average daily gain, daily feed intake and Feed conversion Ratio (FCR) across the treatments. For final weight, T_1, T_2 and T_3 had the highest (P<0.05) values and T_4 had the least value. Similar trend was observed for daily weight gain. Daily feed intake falls between 38.3-41.5g with T1 having the lowest value and T3 had the highest value. Results obtained for blood analysis showed significant (P < 0.05) difference in white blood cell and Total protein across the treatment groups. The highest (P< 0.05) values for white blood cell were recorded in treatments 2,3 and 4 while treatment 1 had the least value. Results of the carcass analysis revealed that the inclusion of high proportion of the pulp in the diet adversely affected carcass yield. It can be concluded that inclusion of African locust bean pulp above 20% in rabbit's diet had adverse effect on growth performance, haematological indices and carcass characteristics.

Keywords: *Carcass; Haemoglobin; Pulp; Rabbits.*

Description of the Problem

The problem of low animal protein intake is wide spread in many developing countries of the world. It was noted by (1) that this arose from the shortfall in supply of meat in the country to meet the demand of the ever-growing population. The average protein intake of an average Nigerian is 34.6g out of which only 10.6g was from animal origin (2).

Rabbits are monogastric animals or pseudo-ruminants that utilizes fibrous plant and convert it into valuable animal protein. Incorporation of concentrates in rabbit's diet is very essential but the use of concentrates for feeding rabbits increases competition for grains with humans and agro-based industries (3). Presently, the scarcity and exorbitant cost of pelleted feed makes rabbit farmers to use un-pelleted feed, even though it has been established that rabbits perform better on pelleted feed (4).

The current situation in feed supply makes it imperative to source for other non-conventional feeds that are not used by man for feeding livestock which should not affect the production capacity of the animals, be available throughout the year and have good keeping qualities (5). There is therefore urgent

need to exploit available but relatively cheap feed resource especially those that are indigenous to our tropical environment (6). African Locust bean pulp *(Parkia biglobosa*) is a wide spread savannah tree, easily recognized by its bright red pendulous flowers. The pods grow in bunches and contains a powdery yellow pulp which has a sweet flavor and contain a gross energy level which compares favourably with that of maize but has low crude fibre content and is free from glucosides (7). It is a potential source of energy because it is very high in carbohydrates and cheaper source of energy (8). This study aims at evaluating the performance, carcass characteristics, haematology and cost benefit of rabbit's fed diets containing different levels of African locust bean pulp.

Materials and Methods

The experiment was conducted at the Department of Animal Science Teaching and Research Farm Modibbo Adama University of Technology, Yola. Yola is located in North-eastern part of Nigeria. It is situated within the Guinea savanna region and lies between latitude 09^{o} 16'N and longitude 12^{o} 35'E and an altitude of about 152m above sea level. Rainy season begins in April and ends in October with mean annual rainfall of 750-1051mm. The ambient temperature ranges between 18-40^{o}C (9)

Source of ingredients

African locust bean (*Parkia biglobosa*) pulp *was* purchased from Yola market and its environments. The pulp was separated from the seeds by crushing in a mortar and the seeds were removed. Other ingredients were purchased from different sources and were used to formulate the experimental diets.

Experimental design

Twenty-four (24) growing rabbits were randomly allocated to four treatment groups with six animals per treatment. Each treatment is replicated thrice in a complete randomized design. Four diets were formulated to include African locust bean pulp at 0, 10, 20 and 30% respectively as shown in Table 1.

Feeding and Management

The rabbits were housed individually in cages measuring 35cm x 36cm x 45cm. The cages were raised one metre above the ground for easy cleaning. The room was cleaned and fumigated one week before the arrival of the rabbits using formaldehyde solution. Thereafter the room was cleaned daily. The rabbits were dewormed using a broad spectrum dewormer. Feed was offered to the rabbits twice daily at 8.00 a.m. and 4.00 p.m. and water was provided *ad libitum*. The rabbits were weighed initially before collection of data and thereafter on weekly basis.

Data Collection

Data was collected over ten (10) weeks on feed intake and weight gain. Feed intake was determined on daily basis. It was done by subtracting feed left over from the feed offered each day. Weighing of the rabbits was done individually on weekly basis and early in the morning before serving feed and water. Initial weight was subtracted from final weight to obtain total weight gain.

Hematological parameters

Blood samples were collected from three (3) animals per treatment using sterile disposables syringe and needles (23 gauge-needles). The samples from each animal was collected in a sample bottle containing Ethylene Diamine Tetra Acetic Acid (EDTA). Parameters determined were packed cell volume PCV, White blood cell WBC, hemoglobin concentration HGC and blood protein using the micro-haematocrit method as reported by (11).

Table 1. Gross composition of experimental diets

Ingredients	Treatments (T) T_1(0%pp)	T_2(10%pp)	T_3(20%pp)	T_4(30%pp)
Maize	45.00	40.50	36.00	31.50
Groundnut	23.00	22.50	22.00	21.50
ALBP	0.00	4.50	9.00	13.50
Maize bran	25.00	25.50	26.00	26.50
Fish meal	4.00	4.00	4.00	4.00
Bone meal	2.00	2.00	2.00	2.00
Premix	0.50	0.50	0.50	0.50
Salt	0.50	0.50	0.50	0.50
TOTAL	**100.00**	**100.00**	**100.00**	**100.00**
Calculated Analyses:				
Energy (Kcal/Kg)	2866.58	2882.24	2874.02	2852.61
Crude protein (%)	18.02	18.97	19.04	18.30
Crude fibre (%)	8.03	8.09	8.30	8.06
Calcium (%)	0.94	1.00	1.06	1.12
Phosphorus (%)	0.45	0.46	0.47	0.48

Composition of premix (Bio mix) vitamin A, 500,000 iu, vitamin D_3 800,000 iu, vitamin E 12,000mg; vitamin K 15,000mg, vitamin B 1,000 mg vitamin B_2 2000mg, Vitamin B_6 15,000mh, Niacin 12,000mg, panthotenic acid 20,00mg, Biotin 10,000mg, Vitamin B_{12} 300.00mg, Folic acid 150,000, Choline Chloride 60,000mg, manganese 10,000mg, iron 15,000mg zinc 800.00mg, copper 400.00mg, iodine 80.00mg cobalt 40mg, selenium 8,000mg.
PP =Parkia Pulp

Evaluation of carcass characteristics

At the end of the experiment (10 Weeks), three (3) rabbits were selected randomly from each treatment for carcass analysis. The rabbits were starved for 12hours to empty their intestinal contents. The rabbits were weighed at the end of the experiment before fasting and after fasting. They were then slaughtered early in the morning for carcass evaluation. The parameters evaluated were head, feet, pelt, organs weight and dressing percentage was calculated.

Cost benefit analysis

The total cost of feed for the treatment groups throughout the period of the experiment was calculated and used for Cost benefit analysis. This is based on the cost of purchase of the ingredients used in feed formulation, as well as the quantity of feed consumed during the course of the experiment and expected income from the animals. The return per treatment was calculated by difference between the estimated income from the animals and the total cost of feed consumed.

Chemical Analysis

The experimental diets and the test ingredient (Pulp) were analyzed for chemical analysis according to (9).

Statistical analysis

Data collected were subjected to analysis of variance (ANOVA) using complete randomized design (10). Means were separated, where applicable using least significant difference (LSD).

Results and Discussion

The chemical composition of African locust bean pulp is summarized in Table 2. The metabolizable energy level obtained in this study is lower than that reported by (6) who reported 3079.14ME/kg but higher than that reported by (11) and (12) who reported 2420 kcal/kg and 2344 kcal/kg respectively. The CP

value of the test ingredient (Pulp) have been stated to be very low in quite a number of literatures. The CP value obtained in this study slightly agreed with those reported by (11) and (12) who recorded values of 3.5 and 3.19% but disagreed with the report of (13) and (14) who recorded higher values of 15.35 and 6.62% respectively.

Table 2. Proximate analysis of experimental diets and pulp.

Parameters (%)	Treatments (T)				
	T_1	T_2	T_3	T_4	Pulp
Moisture	7.40	8.23	4.63	8.03	12.00
Crude Protein	20.86	20.64	19.50	19.16	3.09
Crude Fibre	8.64	8.06	9.40	9.20	12.85
Fats	3.55	3.27	3.91	3.54	2.97
Ash	4.03	4.72	5.24	4.59	3.14
N.F.E.	59.30	57.81	56.31	56.12	61.95
M.E(Kcal/Kg)	3164.5	3080.8	3054.5	2987.92	2554.3
Calcium	0.63	0.58	0.58	0.69	0.15
Phosphorus	0.41	0.41	0.30	0.47	0.08

ME- NFE- Nitrogen Free Extract Metabolizable Energy

The inclusion levels of the pulp had significant ($P<0.05$) influence on all the parameters measured for growth performance as shown in Table 3. The mean daily feed intake was significantly ($P<0.05$) different among the rabbits on various diets. Highest ($P< 0.05$) value was recorded on T_3 (41.50) followed by T_2 (40.20) and T_1 (38.30) while T_4 (39.70) had the least value. The mean daily weight gain was significantly ($P<0.05$) affected by the dietary treatments. Statistically, the values recorded for rabbits on T_1, T_2 and T_3 are similar, while rabbit on T_4 had the lowest. This is higher than the findings of (12) who reported the highest daily weight gain of 7.62g when ALBP is fed to pullet chicks.

Table 3. Growth performance of rabbits fed diets containing different levels of African Locust bean pulp.

Parameters	Treatments (T)				
	T1(0%)	T2 (10%)	T3 (20%)	T4 (30%)	SEM
Initial body weight (g)	566.7	563.3	554.2	570.8	3.30
Final body weight (g)	1057.5^{a}	1104.2^{a}	1099.2^{a}	830.0^{b}	2.16
Mean weight gain (g/rabbit/day)	8.20^{a}	7.73^{a}	7.80^{a}	3.60^{b}	2.16
Feed intake (g/rabbit/day)	38.30^{bc}	40.20^{ab}	41.50^{a}	39.70^{c}	3.47
Feed conversion ratio	4.70^{a}	5.20^{a}	5.30^{a}	11.00^{b}	0.40

$^{a, b}$ Means in the same row with different superscripts are significantly different ($P<0.05$)

The result of blood analysis of growing rabbits (Table 4), showed significant differences ($P< 0.05$) in TP and WBC. Highest ($P< 0.05$) values for WBC is recorded in T_2, T_3 and T_4 while T_1 had the lowest value. This is an indication that inclusion of African locust bean pulp had an influence on the WBC of the experimental animals. (6) reported that mean values of RBC, HGC, BG, BP and organic phosphate decline when ALBP exceed 2.75% of the diet or 5% maize replacement on broilers.

Table 4. Haematological indices of rabbits fed experimental diets

Parameter	Treatments (T)				
	T1	T2	T3	T4	SEM
PCV (%)	27.30	30.70	29.70	31.00	3.06
Hb (g/l)	9.20	9.20	9.90	10.30	0.80
MCHC (g/l)	33.80	30.50	33.20	33.10	2.56
WBC (mm^3)	6.33 [b]	8.40 [a]	9.15 [a]	8.98 [a]	0.67
TP (g/l)	61.00 [b]	61.00 [b]	74.30 [ab]	82.00 [a]	8.63

[a, b] Means in the same row with different superscripts are significantly different (P<0.05)
PCV: Pack cell volume, Hb: Haemoglobin concentration, MCHC: Mean corpuscular haemoglobin concentration, WBC: White blood cells, TP: Total protein.

The result of carcass analysis as indicated in Table 5 did not show any significant (p->0.05) influence on dressing percentage and body components (head, feet, pelt and organs plus contents). The trend shows that from the control, the values increases as the level of pulp increases and decline at 30% inclusion level, (3) also reported similar result on broilers using different levels of ALBP. While (14) using dried poultry waste recorded a similar dressing percentage on rabbits.

Table 5. Carcass analysis of rabbits fed experimental diets

	Treatments (T)				
Parameter	T1	T2	T3	T4	SEM
Average live weight (g)	1057.50[a]	1104.20 [a]	1099.20 [a]	830.00 [b]	2.16
Dressing Percentage (%)	63.80	64.90	66.70	61.20	54.03
Head (g)	12.80	12.90	13.20	14.50	19.13
Feet (g)	5.70	5.50	5.60	7.02	11.78
Pelt (g)	11.80	13.70	11.00	11.00	23.27
Organs + Contents (g)	23.80	22.50	22.30	24.50	39.35
Weight Before Fasting (g)	1308.30[a]	1343.30 [a]	1325.00 [a]	1016.70 [b]	78.45
Weight Before Slaughter (g)	1216.70 [a]	1333.30 [a]	1300.00 [a]	966.70 [b]	92.98
Weight After Slaughter(g).	1158.30 [a]	1308.30 [a]	1275.00 [a]	945.00 [b]	92.17

[a,b] Means in the same row with different superscripts are significantly different (P<0.05)

The economic analysis of the feed cost shows that the estimated return per total weight gained decline progressively as the proportion of the ALBP in the diet increased. The energy levels of the different treatment groups decreased as the level of the pulp increases which lead to the poor performance of the animals in treatment four (30%). If rabbits are sold on live weight basis, little financial benefit will accrue by feeding high proportion of ALBP. But since rabbits are sold in the local markets on per head basis, some good returns may be expected. (15) also produced a similar report when rabbits were fed varying levels of wheat bran.

Table 6. Cost benefit analysis of rabbits fed experimental diets

	Treatments (T)			
Parameters	**T1**	**T2**	**T3**	**T4**
Cost of rabbit (₦)	360	360	360	360
Total live weight gain(g)	564.20	554.20	545.00	248.30
Value of Gain (₦)	282.10	277.10	272.50	124.20
Total Feed Consumed (kg)	2.68	2.81	2.90	2.78
Cost of feed/kg (₦)	50.79	48.10	45.41	42.72
Total Cost of Feed (₦)	136.10	135.20	131.70	118.80
*Return/Rabbits (₦)	146.00	141.90	140.80	5.40

* on the basis of ₦500.00/kg dressed weight

Conclusion and Applications

1. African locust bean pulp can be used as a non - conventional feed in order to reduce cost of feeds
2. Inclusion level of between 10 – 20% PP in the diet of growing rabbits did not have any adverse effect on their performance.
3. The pulp should be purchased during the harvesting season and kept in a good condition to avoid damage by rodents and other storage pest which could reduce the quality of the pulp.

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