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Growth performance and blood profile of weaner rabbits fed different legume haulms supplemented with concentrate

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***Target Audience**: Animal nutritionist, Rabbit farmers and Researchers*

Abstract

A study was conducted to evaluate the effect different forage haulms supplemented with concentrate on the growth performance, nutrient digestibility and blood profile of weaner rabbits. Thirty (30) cross bred weaner rabbits (Chinchilla x Newzealand white) were divided into five groups of six rabbits on equal weight basis and the groups allocated to five dietary treatments consisting of Tridax procumbens haulms (T1), Centrosema pubescens haulms (T2) cowpea haulms (T3), soyabeans haulms (T4) and groundnut haulms (T5) in a completely randomized design for eight weeks. Feeding was done at 5% body weight of the animals such that the rabbits were fed forage haulms at 2.5% body weight and concentrate basal diet at 2.5% body weight in the morning at 08.00hr. Results showed that, final body weight and total body weight gain of rabbits fed T1, T4 and T5 diets were higher than those fed T2 andT3 diets. Rabbits fed T2 and T3 diets recorded poor feed conversion ratio and total body weight gain. The dry matter intake of animals fed T2 and T3 diets was significantly ($p>0.05$) improved compared to those on other treatment diets. Rabbits fed T1, T4 and T5 diets recorded significant ($P<0.05$) higher crude protein digestibility. The result of the haematological and biochemical indices were not significantly ($P>0.05$) affected by dietary treatment. It was concluded from the study that Tridax procumbens haulms, soyabeans haulms and groundnut haulms gave better performance than Centrosema pubescens haulms, cowpea haulms when fed to rabbits in addition to concentrate diet.

***Keywords:** Concentrate, Digestibility, Forage, Growth, Rabbits*

Description of Problem

High cost of conventional feedstuffs is one of the major limiting factor to large scale commercial rabbit production in Nigeria (1). In recent years, more people are involved in rabbit production but are faced with high cost of feeding. It has become imperative to develop appropriate and cost effective feeding systems for rabbit farmers. However, several authors have suggested that, the increasing scarcity of animal proteins and high cost of the conventional feedstuffs in most developing countries can be addressed by incorporating forages in the diets of rabbits (1; 2). Among monogastric animals, rabbit has been reported to utilize fibrous materials for production of meat (3). Studies showed that chemical composition of forages could serve as a potential source of nutrients for animals (4; 5). Forages can be fed in the dry form as hay or fresh. This is of importance to rabbit farmer in the northern part of Nigeria, characterized by long period of dry season. Forage haulms are abundant in northern Nigeria especially during

the peak of harvest. The use of legume haulms in ruminant animal feeding are well documented (6 and 7).

Animal's blood parameters provides the opportunity to analyze its physiological, nutritional and pathological status (8) and it aids in diagnosing nutritional and or environmental stress (9). Certain hematological factors can be associated with certain production characteristics. For examples, packed cell volume and Haemoglobin have been reported as nutritional indicator which are largely influence by the diets fed to the animals (10).There is little or no information on comparative utilization of *Tridax procumbens*, soyabean, *Centrosema pubescens*, and groundnut and cowpea haulms in rabbit feeding. This study therefore, was designed to evaluate the effects of these haulms on the performance of weaner rabbits.

Materials and Methods

The study was conducted at Ganye, Adamawa State. The study area lies between Latitude 8.26' and 11.98'North of the Equator and Longitude 12°3'East of the Greenwich Meridian (11). Soyabean haulms and cowpea husk used for the study were obtained from agro by product market within the study area.

Thirty cross bred weaner rabbits (Chinchilla x Newzealand white) with an initial average weight of 415± 1.89g were procured within study area and assigned to five dietary treatments. Each treatment was replicated three times with two rabbits per replicate in completely randomized design. The rabbits were housed in cages, fitted with feeders and drinkers. A basal diet was formulated (Table 1) and five forage haulms: *Tridax procumbens, Centrosema pubescens, cowpea, soyabeans and groundnut* haulms served as treatment diets. Feeding was done at 5% body weight of the animals such that the rabbits were fed forage haulms at 2.5% body weight and concentrate basal diet at 2.5% body weight

The rabbits were offered experimental diets and water *ad libitum* for the period of 56 days. The animals were weighed at the beginning of the experiment to determine their initial weight and subsequently on a weekly basis. Parameters measured include total weight gain, total feed intake, and feed conversion ratio (FCR). The digestibility study was conducted after the feeding trial (56 days). The animals were transferred to metabolic cage. Feaces were collected for seven days after three days of adaptation period. At the end of the collection period all sample from each animal was bulked, thoroughly mixed and sub-sample taken for proximate composition according to (12).

Blood samples were collected from three rabbits per treatment on the 56th day of the experiment for determination of hematological and biochemical components as described by (13). 5mls of blood was collected by puncturing the jugular vein and allowing free flow of blood into labeled sterile universal bottle containing 1.0mg/ml ethyl diamine tetracetic acid (EDTA) as anticoagulant to determine the haematological component according to the methods described by (13,14). Another 5mls was also collected into a labeled sterile sample bottles without anticoagulant to determine the biochemical components (13, 14).

Data collected were subjected to one way analysis of variance using SAS (15) means were separated using Duncan's Multiple Range Test of the same software.

Table 1: Ingredient composition of experimental diet

Ingredients	% inclusion
Maize	49.00
Maize offal	13.00
Soybean meal	25.00
Fishmeal	2.00
Kapok cake	7.00
Bone meal	2.50
Methionine	0.25
Lysine	0.25
Salt	0.50
Premix	0.50
Total	100
Analyzed composition (%)	
Dry matter	97.34
Crude protein	17.80
Crude fibre	8.35
Ether extracts	4.68
Ash	6.90
NFE	59.61
*ME	3153.84

*ME (Kcal/kg) was calculated using the formula of Pauzenga (16). ME = 37 × %CP + 81 ×%EE + 35.5 × NFE. Where ME is the metabolizable energy; CP, crude protein; EE, ether extract and NFE, the nitrogen free extract.

Results and Discussion

Table 2 shows the proximate of composition of forage haulms. The result showed significant differences ($p<0.05$) in all the parameters measured across except dry matter (DM). Metabolisable energy was highest in T1 (*Tridax procumbens*) 2777.43kcal, T3 (Cowpea haulm) 2494.51 kcal, T4 (soyabeans haulms) 2565.53 kcal and T5 (groundnut haulms) 2082.33kcal and lowest in T2 (*Centrosema pubescence*) 1920.08 kcal. This is an indication that all the forage haulms are high in metabolisable energy. The dry matter ranged from 90.78 % in (T2) to 95.89% (T1) in. The Crude protein (CP) was significant higher in T1 and range between 12.45% in T5 to 37.31% in T1. The CP values are within the range of 10-38% reported by (17). Ash content was significantly ($p<0.05$) highest (17.61%) in T5 and lowest (4.28%) in (T1). This is an indication that (T2) has the highest content of minerals which is essential in animals' metabolism. The ash content of forage haulms obtained in this study within the range reported by (17). Ash represents the mineral level in a feed, which contains majorly phosphorus, calcium or potassium and large amount of silica (18). The crude fibre values for T2 (33.21%) and T3 (20.60%) were higher than 18.00% and 12.78 reported by (19). The variation may be due to the processing methods, plants species, and age of harvesting and maturity of the selected haulms.

Table 2: Proximate composition of different forage haulms fed to weaner rabbits

Parameter (%)	T1	T2	T3	T4	T5	SEM	P-value
Dry matter	95.89	90.78	93.78	91.05	92.1	3.89	0.12
Crude protein	37.31[a]	21.89[b]	19.56[c]	24.89[b]	12.45[d]	1.06	0.04
Crude fibre	16.00[c]	33.21[a]	20.60[b]	15.89[c]	19.14[b]	0.83	0.02
Ether extracts	0.82[c]	2.03[a]	1.78[b]	1.87[b]	2.17[a]	0.06	0.01
Ash	4.28[d]	7.01[b]	6.02[c]	6.34[c]	17.61[a]	0.27	0.03
Nitrogen free extracts	37.48[c]	26.64[d]	45.82[a]	42.06[a]	40.73[b]	1.66	0.05
*ME (Kcal/kg)	2777.43[a]	1920.08[b]	2494.51[a]	2565.53[a]	2082.33[a]	103.97	0.03

*ME (Kcal/kg) was calculated using the formula of Pauzenga (16). ME = 37 × %CP + 81 ×%EE + 35.5 × NFE. Where ME is the metabolizable energy; CP, crude protein; EE, ether extract and NFE, the nitrogen free extract.
T1= *Tridax procumbens* haulms
T2= *Centrosema pubescens* haulms
T3= Cowpea pea haulms
T4= Soyabeans haulms
T5= Groundnut haulms

There were significant variation ($p<0.05$) in final body weight, average daily feed intake and total body weight gain between dietary treatments (Table 3). No mortality was recorded during the experiment. Rabbits fed T2 and T3 diets recorded significant higher ($p<0.05$) average daily feed intake. The higher feed intake of rabbits on T2 and T3 diets could be attributed to crude fibre content of T2 and T3 as shown in Table 2. The finding agreed with earlier reports of (20) and (21) who reported that high fibre diets tend to increase feed intake in rabbits. Rabbits have been reported to adjust their feed intake voluntarily to meet their energy requirements (22). Forage haulms have been reported to affect voluntary feed intake (1, 23) depending on the nature of the fibre. Rabbits on T2 and T3 diets had significantly ($p<0.05$) lower weight gain than those on T1, T4 and T5. Rabbits fed T1, T4 and T5 diets had the highest ($p<0.05$) weight gain. The higher weight gains of rabbits on T1, T4 and T5 diets could be due to efficient utilization of nutrient by the animals. (14) reported that the ability of rabbits to utilize highly fibrous diets may depend on the level of replacement, nature of the fibre source, age of the rabbit and length of the adaptation period of their digestive system to the fibre source. This implied that the fibre content of diet's T1, T4 and T5 were properly utilized. The results for the final body weight followed the same trend with that of the weight gains. Rabbits fed T1, T4 and T5 diets had significant higher ($p<0.05$) final body weight while those on T1 and T2 diets had the least final body weight. Feed conversion ratio results showed that, rabbits on T2 and T3 recorded poor feed conversion ratio compared to those on T1, T4 and T5. This suggests poorer feed conversion of *Centrosema pubescens* haulms (T2) and cowpea haulms (T3) diets to weight gain than *Tridax procumbens* haulms (T1), soyabeans haulms (T4) and groundnut haulms (T5) diets.

The results of the nutrient digestibility (Table 3) showed significant differences ($p<0.05$) among dietary treatments for all the parameters measured. Rabbits fed T2 and T3 had higher dry matter intake than those fed diets T1, T4 and T5 diets had the lowest. Feed intake and dry matter intake in monogastrics has been reported to be a function of dietary fibre and energy (24).The dry matter digestibility values for the animals fed T1, T4 and T5 diets were significantly ($p<0.05$) higher compared to those on T2 and T3 diets. Studies have shown that dietary fibre increases dry matter digestibility (25). Significant

increase in dry matter digestibility for rabbits on T1, T4 and T5 diets could be due to the nature of fiber content in the diet. The crude protein digestibility was significantly (P<0.05) affected. Rabbits fed T1, T4 and T5 diets recorded higher crude protein digestibility than those fed T2 and T3 diets. The result confirmed earlier findings of (20) who reported significant decrease in crude fibre digestibility when high fibre diets was fed to weaner rabbits. The variation in the crude fibre digestibility values among rabbits fed dietary treatment could be due to the type of fibre in the diets. Fibre from different sources could vary in their digestibility depending on the proportions of hemicellulose, lignin and cellulose (1). High fibre level in diets normally speed up the rate of feed passage in the gut. The feed is thus exposed to the action of enzymes for a shorter period which could be responsible for reduction in its digestibility.

Table 3 Growth performance and nutrient digestibility of weaner rabbits fed forage haulms supplemented with concentrate

	Dietary treatments						
Parameters	T1	T2	T3	T4	T5	SEM	p-value
Initial body weight (g/rabbit)	415.11	416.67	403.33	413.00	413.00	0.41	0.89
Final body weight (g/rabbit)	1511.20^{a}	1040.33^{b}	1064.60^{b}	1490.40^{a}	1653.70^{a}	1.35*	0.03
Average body weight gain (g/rabbit)	19.57^{a}	11.13^{b}	11.75^{b}	19.23^{a}	22.15^{a}	0.16*	0.01
Average daily feed intake (g/rabbit)	50.76^{b}	64.99^{a}	62.20^{a}	50.09^{b}	48.50^{b}	0.05*	0.02
Feed conversion ratio	2.59^{b}	5.83^{a}	5.29^{a}	2.66^{b}	2.27^{b}	0.03*	0.12
Dry matter intake	41.11^{b}	50.24^{a}	51.56^{a}	40.78^{b}	41.25^{b}	0.40	0.03
Dry matter digestibility	78.53^{a}	69.25^{c}	66.25^{c}	79.25^{ab}	80.32^{a}	0.70	0.05
Crude protein digestibility	83.17^{a}	71.11^{b}	73.35^{b}	80.32^{a}	81.46^{a}	0.77	0.02
Crude fibre digestibility	79.82^{a}	55.31^{b}	54.32^{b}	78.12^{a}	80.25^{a}	0.66	0.01

Means in the same row bearing different superscripts differ significantly (P<0.05), SEM = Standard error mean
T1= *Tridax procumbens* haulms
T2= *Centrosema pubescens* haulms
T3= Cowpea pea haulms
T4= Soyabeans haulms
T5= Groundnut haulms

The results of the haematological parameters of grower rabbits fed forage haulms supplemented with concentrate is presented in Table 4. The parameters evaluated were similar across the treatment groups (P>0.05).Packed cell volume (PCV) range from 40.23 to 42.12% for rabbits in T1 and T4 diets. Haemoglobin (Hb) values were between 10.09g/dl to10.81 g/dl. White blood cell (WBC) were within the range of 8.02 – $8.67\times10^{6}/mm^{3}$, while red blood cell (RBC) was between $8.06\times106/mm^{3}$ in T5 to $8.67\times106/mm^{3}$ in T3. The results of the biochemical indices of grower rabbits also revealed similarity (P>0.05) across the treatment groups. The values of packed cell volume (PCV), haemoglobin concentration (Hb and red blood cell count (RBC) obtained in this study fall within the physiological range reported by (26, 27). PCV and Hb have been reported as nutritional indicator which are largely influence by the diets fed to the animals (10). The WBC values are within the normal range ($7\text{-}15\times106/mm^{3}$) reported by

(26). This implies that the experimental diets were safe for rabbit consumption. The non-significant differences in biochemical indices across the dietary treatments showed the adequacy of nutrients in the diets as documented by (28). Similarity of the serum albumin values of rabbits also imply the presence of a healthy and functioning liver, protein: energy balance in the diets and absence of parasitic infections. (29)

Table 4 Haematological and biochemical indices of weaned rabbits fed forage haulms supplemented with concentrate

	Dietary treatments						
Parameters	T1	T2	T3	T4	T5	SEM	p-value
PCV (%)	40.23	41.33	42.07	42.12	40.08	1.50	0.34
Haemoglobin (g/dl)	10.04	10.19	10.09	10.81	10.15	0.27	0.67
RBC ($\times 10^6$/mm^3)	8.12	8.39	8.53	8.30	8.06	0.31	0.68
WBC ($\times 10^6$/mm^3)	8.02	8.67	8.15	8.28	8.14	0.12	0.56
Lymphocyte %	42.95	42.20	46.09	40.38	44.78	0.75	0.34
Eosinophil %	2.12	2.10	2.03	2.10	2.20	0.19	0.45
Neutrophils %	42.15	41.89	42.90	41.05	40.99	0.36	0.34
Biochemical indices							
Cholesterol(mg/dl)	66.20	64.29	65.40	62.55	64.76	0.37	0.87
Total protein (g/dl)	5.55	5.63	5.65	5.43	5.56	0.90	0.54
Albumin (g/dl)	3.50	3.42	3.20	3.10	3.16	0.02	0.21
Globulin (g/dl)	2.05	2.21	2.45	2.33	2.40	0.01	0.08
Urea (mg/dl)	35.32	34.21	33.65	35.18	33.27	0.29	0.57

SEM= Standard error, PCV= Packed cell volume RBC=Red blood cell, WBC= While blood cell

Conclusion and Applications

1. *Tridax procumbens*, soyabeans and groundnut haulms supplemented with concentrate improved the growth performance of weaner rabbits
2. Similarity among haematological and biochemical indices showed the absence of pathological abnormalities
3. Animal nutritionist and rabbit farmers are therefore recommended to use *Tridax procumbens*, soyabeans and groundnut haulms supplemented with concentrate in rabbit feeding.

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