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Original article

Growth response and haematological parameters of juvenile rabbits fed concentrate diets supplemented with varying levels of tridax procumbens

J.I. Obinne[a,*], F.U.C. Mmereole[b], J.C. Okonkwo[c]
[a]*Department of Agricultural Education, Federal College of Education (Technical), Asaba-Delta State, Nigeria.*
[b]*Department of Animal Science, Delta State University, Asaba Campus, Asaba- Delta State, Nigeria.*
[c]*Department of Animal Science and Technology, Nnamdi Azikiwe University, PMB 5025 Awka, Anambra, Nigeria.*

*Corresponding author; Department of Agricultural Education, Federal College of Education (Technical), Asaba-Delta State, Nigeria.

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ABSTRACT

Effects of feeding growing rabbit with varying dietary levels of concentrate diet supplemented with graded Tridax procumbens was studied in a feeding trial with respect to weight changes, haematological and serological characteristics. Thirty six hybrid fryers were used in a Completely Randomised Design (CRD). Dietary treatment produced significant ($P<0.05$) effect on weight changes. Increasing levels of crude protein in the concentrate diet supplemented with graded Tridax procubens resulted in marked and steady increase in body weight of rabbits. There were significant ($P<0.05$) differences in haematological and serological characteristics of the rabbits. The 14% crude protein diet with Tridax procubens supplementation produced the highest WBC, Neutrophils and monocytes while the 16% crude protein diet with Tridax procumbens gave the best serum chemistry. Findings suggested that concentrate diet containing not less than 14% crude protein with Tridax procumbens supplement were adequate for optimum weight changes and improved blood system of growing rabbits in the humid tropics.

1. Introduction

The high cost of feed remains the greatest challenge to livestock production particularly monogastric animals in Nigeria. Grains which form bulk of concentrate feed are in short supply and expensive. Moreover, the price of animal protein concentrate has risen astronomically. It has been found that it is economical to rear rabbits on mixed diet of concentrate and forage (Farinu, 1994; Akpodiete et al., 1999; Roy et al., 2002; Okonkwo et al., 2010; Mmereole et al., 2011). However, investigators have reported significant effect on weight changes, haematological and serological characteristics of rabbit, Taiwo et al. (2004) observed higher weight gain in rabbits fed mixed regime of Tridax procumbens with concentrates than those on sole concentrate. Moreover, Ahamefule et al. (2006) reported significant effect of dietary treatment on PCV, MHC, Neutrophils and HB. Monocyte value obtained was significant at low crude protein content. Except for WBC, haematological parameters were influenced by dietary treatments (Arejinwa et al., 2002). Contrary to these reports, Omoikhojo et al. (2006) found that all haematological and serum chemistry of rabbits fed syndrella nodiflora forage were not significantly affected by the dietary treatments. In a similar investigation Ngodiagha and Okejim (1999) found that weight gain of weaner rabbits fed graded levels of sweet potato meal were not significant. The conflicting reports necessitated further investigation. The experiment was, therefore, conducted to investigate the effect of crude protein levels supplemented with Tridax procumbens on weight changes and blood variables of growing rabbits.

The forage, Tridax procumbens, belongs to the family Asteraceae (Sexena and Albert, 2011). The plant bears daisy like yellow-centred white or yellow flower with three-toothed ray florets and are found in fields, meadows, crop lands, disturbed areas, lawns and roadsides in areas with tropical and semi-tropical climates. The forage is the most relished herbage by rabbits (Obinne, 2005).

2. Materials and methods

The experiment was carried out for a period of 42 days (6weeks) at the Teaching and Research Farm of the Department of Animal Science, Delta State University, Asaba campus, Delta State of Nigeria. There were four diet groups comprising;

Diet 1 = 12% Crude Protein supplemented with T. Procumbens

Diet 2 = 14% Crude Protein supplemented with T. Procumbens

Diet 3 = 16% Crude Protein supplemented with T. Procumbens

Diet 4 = 16% Crude Protein without T. Procumbens supplementation (control diet)

The diets consisted of a control containing concentrate of 16% crude protein but no T. Procumbens. The diet were formulated to be iso-caloric but not iso-nitrogenous (Table 1). Thirty six, 5-6 week old, hybrid weaner rabbits obtained from crosses between New Zealand white and Chinchilla breeds of mixed sexes were used for the study. At the start of the experiment, the rabbit were weighed individually and assigned to four dietary treatments containing three replicates of three weaner rabbits in a Complete Randomised Design (CRD). The diets were analyzed for proximate composition (Table 2) according to AOAC (1980).

The rabbits were stabilized on the diets for four days before starting the experiment. The diets and clean water were supplied ad libitum in earthen pots once daily throughout the duration of the experiment. The forage was supplied on the forage racks. Data were collected on weight changes and blood parameters. The rabbits were weighed at the start of the experiment and on weekly basis thereafter and daily weight gain calculated by dividing the difference between two consecutive weighing by 7.

At the end of the experiment, 6 rabbits were slaughtered per treatment (that is, 2 rabbits per replicate) and used for haematological and serological studies. Blood samples were collected from the ear veins of the animals between 8.00 and 9.00am. The haematological samples were collected into sample tubes containing ethylene diamine tetra-acetic acid (EDTA) as anticoagulant while samples for serology were collected into anticoagulant-free tubes. The blood samples were analyzed according to routine laboratory procedure as described by Surror and Schillhornyam (1977). Data were subjected to analysis of variance using the procedure outlined by SAS (2002) and significantly different means were separated using the Multiple range test by Duncan (1955).

Table 1
Feed ingredients composition (%) of the experiment diets.Treatment Groups.

Ingredients	T 1 (Diet 1)	T 2 (Diet 2)	T 3 (Diet 3)	T 4 (Diet 4)
Maize	30.00	30.00	30.00	30.00
Soya bean meal	5.40	6.50	12.65	12.65
Palm kernel meal	10.00	10.00	10.00	10.00
Fish meal	0.50	0.50	0.50	0.50
Wheat offal	10.00	10.00	10.00	10.35
Maize offal	40.60	39.00	33.35	33.35
Bone meal	2.00	2.00	2.00	2.00
Oyser shell	1.00	1.00	1.00	1.00
Common salt	0.25	0.25	0.25	0.25
Vita. Premix*	0.25	0.25	0.25	0.25

*Supples per kg of feed: vit A, 1500 i.u., vit E, 11.00mg, riboflavin 9.00mg, panthothenic acid 11.00mg, biotin 0.25mg, vit k, 3.00mg, B12 8.00mg, Fe, 5.00mg, Mn 10.00mg, nicotinic acid 8.00mg, Zn, 4.5mg, Cu,0.2mg, Se. 0.01mg

Table 2
Analyzed proximate composition of experimental diets.

Nutrients	Treatments			
	T 1	T 2	T 3	T 4
DM (dry matter)	87.00	89.50	89.00	89.00
Ash	10.65	10.93	10.00	10.83
Crude fibre (CF)	10.93	10.78	11.10	9.45
Ether extract (EE)	3.65	3.90	3.70	2.98
Crude protein	12.12	14.18	16.09	16.02
NFE	69.65	49.71	48.11	49.72
Cal. Values				
Crude Protein (%)	12.11	14.00	16.00	16.00
Gross energy (kcals/kg)	2639.34	2651.61	2635.34	2642.49

Table 3
Proximate analysis of Tridax procumbens leaf and stem.

Nutrients	Leaf	Stem
Moisture(%)	90.05	88.30
Ash (%)	0.20	0.50
Crude fibre (%)	0.61	1.92
crude protein (%)	3.44	4.38
Carbohydrate (%)	5.10	4.80
Crude Lipid (%)	0.60	0.10
Metabolizable energy kcal/100g	39.56	39.62

3. Results

The weight changes of the rabbits are summarized in Table 4. There was a significant ($p<0.05$) effect of dietary treatment on weight changes. Increasing levels of crude protein in the concentrate feed supplemented with T. Procumbens resulted in steady increase in body weight of 15.66g, 16.65g and 17.81g for rabbits on diets 1, 2 and 3 respectively. Weight gains of rabbits fed concentrate feed deprived of forage (Diet 4) dropped significantly ($P<0.05$) to 14.24g. Therefore, 16% crude protein with Tridax procumbens supplementation supported the highest daily live weight gain in the rabbit. The results of the haematological analysis of the experimental rabbits fed varying crude protein levels supplemented with T. Procumbens is shown in Table 5. From the table, it can be observed that there were significant ($P<0.05$) differences in the haematological characteristics among the different dietary groups except for Basophils which did not exist in the rabbit blood. Rabbits fed 16%crude protein with

Tridax gave highest yield of HB (10.73g) and Lymph (43.00%). The responses of PCV of the rabbits to varying crude protein concentration in diets1, 2, 3 and 4 are 34.43%, 31.30%, 31.33% and 31.16% respectively. Rabbits on diet 1 containing 12% crude protein with Tridax recorded the highest PCV value. The 14% crude protein content with Tridax produced significantly ($P<0.05$) highest WBC value. The same trend was recorded for Neutrophils and Monocytes. RBC yield did not differ ($p>0.05$) among treatments. Basophil cells did not exist in the blood of the rabbits. It is clear from these results that highest values on haematological characteristics comprising HB, Lymph, WBC, Neutrophils and Monocytes were obtained with diets containing 14% and 16% crude protein supplemented with T. Procumbens.

Results of serological characteristics of the experimental rabbits fed varying crude protein levels with T. Procumbens supplementation are presented in Table 6. From the table, it can be seen that the different dietary groups produced significant ($P<0.05$) effect on the serum biochemistry of the rabbits. The blood sugar levels were 70.00mg, 68.33mg, 72.66mg and 74.66 mg for rabbits in diet groups 1, 2, 3, and 4 respectively. The blood sugar level for rabbits on control diet (Diet4 =74.66mg) was significantly higher than the record of the rabbits in other diet groups while the rabbits fed on diet 2 had the least blood sugar level (68.33mg). Total protein was significantly ($P<0.05$) higher in rabbits placed on 16% crude protein supplemented with T. Procumbens (42.00mg). The value obtained is, however, not significantly ($p>0.05$ different from the values of 41.0mg and 40.0mg recorded by rabbits on diet groups 1and 4. Diet 3 containing 16%crude protein with T. Procumbens also produced rabbits with significantly ($P<0.05$) higher Albumen values. Records of Globulin are 15.16mgmg, 12.66mg, 14.16mg and 13.66mg for rabbits fed on diet 1, 2, 3 and 4 respectively. The figure was significantly ($p<0.05$) higher in rabbits placed on diet 1 but the value was not significantly ($P<0.05$) different from that obtained by rabbits fed diet 3. These results suggest that 16% crude protein diet supplemented with T. Procumbens improved the serum chemistry of rabbit.

4. Discussion

The marked improvement in weight changes obtained with higher crude protein content of concentrate feed supplemented with T. Procumbus showed the ability of the rabbits to gain more weight on diet formulated to contain forage than diet based solely on concentrate (Okonkwo et al., 2010; Taiwo et al., 2004). This may have resulted from the ability of rabbits to utilize up to75% 0f the protein in the forage plants (Cheeke, 1974) and the natural tendency to ferment forages in their enlarged caeca and thus able to release the nutrients including protein from the crude fibre (Okonkwo et al., 2010; MMereole et al., 2011)

Results indicated that diets had highly impressive effect on the haematology of growing rabbits. This finding is consistent with the report of Arejinuwa et al. (2001) that haematological parameters in rabbits were influenced significantly by dietary treatments. It further lends support to the finding of Ahamefule et al. (2006) that there were significant differences in PCV, WBC, and Neutrophil of rabbits fed sun-dried, ensiled and fermented cassava peel based diets. The pattern of the haematological characteristics of the rabbits is traceable to the diets as rabbits deprived of forage (Diet4) produced significantly least values of PCV, HB and monocyte. The higher haematological obtained by the rabbits fed on diets containing 14% and 16% crude protein supplemented with T. Procumbens is noteworthy. It showed that the right combination of protein and forage is to be located in these diets.

Serological analyses revealed that dietary treatments produce significant effect on serum chemistry of the young rabbits. This result, however, does not agree with the report of Omoikhojo et al. (2006) that dietary treatment of concentrate feed supplemented with varying levels of syndrella nodiflora forage did not significantly affect the serum chemistry of rabbits. All the serological parameters evaluated were significantly higher in rabbits fed diet 3 except for blood sugar value which was highest in rabbits on diet 4 (control diet). The higher concentration of sugar is attributed perhaps to higher intake of concentrate which is usually high in starch since the diet was deprived of forage. Blas and Gidenne (1998) found that starch digestion in rabbit as in other livestock results finally in the release of sugar which in principle is absorbed in situ.

The results so far indicated that inclusion of T. Procumbens in the diet of rabbits not only enhanced weight changes but also improved their well-being by preserving the qualities of their blood system. Based on these findings, it is inferred that concentrate diet containing not less than 14% crude protein with T. Procumbens is appropriate for optimum weight changes and improved blood systems of growing rabbits in the humid tropics.

Table 4

Weight changes of rabbits fed varying levels of crude protein with and without forage supplementation.

	Treatments					
Parameters	**T 1**	**T 2**	**T 3**	**T 4**	**Mean**	**±SEM**
Avg. daily feed intake (g)	94.10c	85.21d	96.53b	109.00a	96.21	0.09
Initial body weight (g)	552.13a	552.89a	551.92a	551.82a	552.19	0.43
Final body weight (g)	1209.66c	1252.00b	1300.00a	1150.00d	1227.92	2.82
Avg. daily weight gain (g)	15.66c	16.65b	17.81a	14.24d	16.09	0.32

a, b, c, d, means with a common superscript in the same row are not significantly (p>0.05) different.

Table 5

Haematological characteristics of growing rabbits fed varying levels of crude protein with and without forage supplementation.

	Treatments					
Parameters	**T 1**	**T 2**	**T 3**	**T 4**	**Mean**	**±SEM**
PCV (%)	34.43a	31.30b	31.33b	31.16b	32.01	0.26
HB g/dl	10.32bc	10.46b	10.73a	1026c	10.44	0.04
WBC (103 U/I	17.33b	19.66a	13.33d	14.66c	16.25	0.32
Neutrophils (%)	51.33d	60.66a	57.00b	54.06c	55.76	0.18
Lymph (%)	22.50c	35.30b	43.00a	43.33a	36.03	0.57
Monocyte (%)	1.53b	2.36a	0.01c	0.02c	0.98	0.04
Basophils (%)	0.00a	0.00a	0.00a	0.00a	0.00	0.00
RBC (10 12/1)	8.00a	8.00a	8.00a	8.30a	8.08	0.04

A, b, c, d, means with a common superscript in the same row are not significantly (p>0.05) different.
PCV:Packed cell volume
HB: Haemoglobin
WBC: white Blood Cell
RBC: Red Blood Cell

Table 6

Serological characteristics of growing rabbits fed varying crude protein levels with and without forage supplementation.

	Treatments					
Parameters	**T 1**	**T 2**	**T 3**	**T 4**	**Mean**	**±SEM**
Blood sugar (mg/100ml)	70.00c	68.33d	72.66b	74.66a	71.41	0.25
Total protein (mg/100ml)	41.00ab	37.00b	42.66a	40.00ab	40.17	0.86
Albumen (mg/100ml)	25.33b	21.66c	27.66a	25.66b	25.08	0.41
Globulin (mg/100ml)	15.66a	12.66c	14.66ab	13.66bc	14.16	0.33

a, b, c, d, means with a common superscript in the same row are not significantly (p>0.5) different.

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