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Haematological and serum biochemical characteristics of weaner rabbits fed plantain leaf and concentrate

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Target Audience: Animal Nutritionist, Rabbit Farmers, Animal Physiologists

Abstract

An experiment was undertaken with 30 mixed bred rabbits (6-8 weeks), with initial weight of 0.70 ± 0.02 kg, to assess their haematological and serum biochemical response when fed plantain leaf and concentrate. The plantain leaf was offered at levels of 0g, 25g, 50g, 75g and 100g in treatment 1 (control), 2, 3, 4 and 5 respectively, with six rabbits per treatment and for an eight week feeding trial. Control had concentrate alone. The growth performance in terms of final liveweight ranged from 0.98 kg (T2) – 1.50kg (T4). After the feeding trial, blood samples were collected for haematological and serum analysis. The packed cell volume, haemoglobin, red blood cell, mean cell volume, mean cell haemoglobin, mean cell haemoglobin concentration, monocytes and Eosinophils were similar (P>0.05) amongst the five treatments, except total white blood cell, neutrophils, leukocyte counts and platelet counts which were significantly (p<0.05) different. The alanine amino transferase, aspartate amino transferase, alkaline phosphatase activities and creatinine levels of rabbits fed plantain leaf were not significantly different (P>0.05) from those fed the control treatment. This invariably suggests that feeding plantain leaf up to 100g in rabbit diet per day will not illicit any deleterious effect on the blood profile of weaner rabbits.

Key words: *Musa paradisiaca leaf, weight, blood indices, electrolytes,*

Description of Problem

The obvious advantage of rabbits over other livestock cannot be overemphasized. This is because it has abundant potential to meet the animal protein needs of the population especially in developing countries where the supply (animal protein) is grossly inadequate (1). Rabbits have been noted to be prolific and capable of utilizing forages (2). Cheeke *et al.* (3) also reported that the meat has medicinal value while the high protein content of the meat couple with low cholesterol and sodium levels have been documented by authors such as Biobaku and Oguntona (4) and Holmes et al. (5) In addition, rabbit production requires low capital investment, less space per unit number and there is no cultural biases or religion hindrances to its consumption (4). The plantain (*Musa paradisiaca*) of the family, musaceae, genus, *Musa*, is a starchy food consumed by about 70 million people in different parts of the world in different ways (6). According to (7), plantains are a useful source of carotene, vitamin A, potassium and iron which are essential for healthy living apart from being an economical source of dietary energy. Plantain by-products can be utilized such as stalk, leaves and peels in soap production and tenderizers because of high potassium content (8), and in preservation of foodstuff such as kolanuts. The abundance of plantain leaves in

most part of the country is a good indication that the plant can be successfully incorporated into microlivestock feeds instead of allowing it to waste. The haematological and biochemical evaluations are indicators of the effects of nutrition or dietary components in terms of antinutrients and other interplay of nutrients on the performance of the animal (9)-(10). There is paucity of information on the use of and availability of plantain leaf fed as forage to rabbits. This study was therefore designed to ascertain the effect of feeding the plantain leaf (fresh) on the haematological and serum biochemistry of weaner rabbits.

Materials and Methods

Experimental design, site and management of animals

The study was carried out at the Rabbit Unit of the Teaching and Research Farm, University of Uyo, Uyo, Nigeria. Thirty (30) mixed-bred rabbits at weaning stage were used for the experiment. The rabbits used for the study were between 6-8 weeks of age with initial body weight range of 0.65kg – 0.75kg (0.70 ± 0.02 kg). The experiment lasted for 56 days and the animals were acclimatized and quarantined during the physiological adjustment period for 2 weeks. The rabbits were allotted randomly in a completely randomized design into five treatments, with each treatment possessing six rabbits, as replicates, housed in metallic hutches.

Preparation of Experimental Diets

Rabbits were bought from a reputable rabbit farmer in Uyo, AkwaIbom State while the plantain leaves were harvested from household farms, school farm and fed fresh. A concentrate diet was formulated as seen in Table 1 while Table 2 shows the proximate composition of the concentrate diet and plantain leaf. The experimental diets consisted of the following:

Treatment 1: 60g concentrate alone
Treatment 2: 30g concentrate plus 25g plantain leaf
Treatment 3: 30g concentrate plus 50g plantain leaf
Treatment 4: 30g concentrate plus 75g plantain leaf
Treatment 5: 30g concentrate plus 100g plantain leaf

Table 1: Composition of concentrate diet

Ingredients	%
Maize	58.00
Soya bean meal	10.00
Wheat offal	10.00
Fish meal	7.00
Bone meal	10.00
Palm kernel cake	1.50
Salt	0.50
Premix	2.50
Lysine	0.25
Methionine	0.25
Total	**100.00**

Table 2: Proximate composition of concentrate diet and plantain leaf

Parameters	Concentrate (%)	Plantain leaf (%)
Dry matter	92.74	36.85
Moisture	7.26	63.15
Protein	19.30	10.98
Fat	11.11	1.84
Crude fibre	9.97	8.11
Ash	18.18	13.55
Nitrogen free extract	41.44	65.52

Data Collection and Analysis

The rabbits were balanced for weight to obtain uniform initial weights across treatments. Thereafter, weekly weights were measured to determine the weight gains. Feed intake was determined by obtaining the difference between the quantity of feed and forage offered and the left over. Data so generated were used to calculate the body weight changes and feed conversion ratio.

At the end of the feeding trial, blood samples were collected from the ear vein of each rabbit using a sterilized disposable syringe and needle before their meal. An initial 2 ml of blood was collected into labelled sterile vacutainer tube containing ethylene-diamine-tetra-acetic (EDTA) as anti-coagulant which was used for haematogical analysis. Another 3 mls of blood was collected into labelled sterile sample bottles without EDTA and used for the serum biochemical analysis. Alkaline phosphates (ALP), Alanine amino transferase, and aspartate amino transferase activity were determined using spectrophotometric method. The red blood cell (RBC) counts, total white blood cell (TWBC) counts, haemoglobic (Hb) concentration and packed cell volume parameters were determined as described by (11). Blood constants (MCV, MCH, MCHC) were determined using appropriate formulae as described by (12). Serum glucose and urea were estimated by methods described by (13) while total cholesterol and other lipid profiles were determined by colorimetric enzyme method as outlined by (14).

Data Analysis

All data collected for the determination of various indices in respect of the five treatments were subjected to analysis of variance (ANOVA) according to (15) and where significant differences between the means were indicated. New Duncan's Multiple Range Test (NDMRT) as outlined by (16) was used to separate the means.

Results and Discussion

Table 3 shows the growth performance of rabbits fed plantain leaf. The mean dry matter intake of rabbits were 55.91g, 50.38g, 72.53g, 92.80g and 113.10g per day while their mean weight gain were 12.14g, 4.11g, 7.14g, 6.25g and 11.96g per day for treatments 1, 2, 3, 4 and 5 respectively. Final live weight range of the rabbits was 0.98kg – 1.50kg.

The final live weight and average daily weight gain in this study is comparable to those reported by (17) of 1.07 – 1.34 kg and 7.14 – 12.03 g/day respectively. Banana leaves cannot meet animal requirements alone, therefore supplementation with nitrogen and energy are suggested (18).

Table 3: Growth performance characteristics of rabbits

	T1	T2	T3	T4	T5	SEM
Initial weight (kg)	0.70	0.75	0.70	0.70	0.65	0.11
Final weight (kg)	1.38^{a}	0.98^{c}	1.10^{bc}	1.50^{c}	1.32^{ab}	0.08
Weight gain (kg)	0.68^{a}	0.23^{c}	0.40^{ab}	0.35^{ab}	0.67^{a}	0.05
Daily weight gain (g/d)	12.14^{a}	4.11^{c}	7.14^{ab}	6.25^{ab}	11.96^{a}	0.02
Dry matter intake (g/d)	55.91^{d}	50.38^{e}	72.53^{c}	92.80^{b}	113.10^{a}	12.04

abc means on the same row with different superscripts are significantly different ($p<0.05$)

Data on haematological indices of the rabbits fed plantain leaf is presented in Table 4. The diet did not have any significant (P>0.05) effect on the following parameters: packed cell volume (PCV), haemoglobin (Hb), red blood cell (RBC), mean cell volume (MCV), mean cell haemoglobin (MCH), mean cell haemoglobin concentration (MCHC), monocytes and eosinophils, but there were significant (P<0.05) effects on total white blood cell, neutrophils, and platelet counts. The values were comparable with the ranges obtained by (19) in a study with graded levels of Moringa leaf meal on growing rabbit. Earlier (20) had indicated that haematological characteristics of livestock suggested their physiological disposition to the plane of nutrition. The packed cell volume, red blood cell and white blood cell obtained in this study were within the ranges reported by (21) for healthy young rabbits. Except for animals on T4 which recorded a low TWBC value suggesting an allergic condition and certain parasitism (22).

Table 4: Haematological Indices (x±SD) of weaner rabbits fed plantain leaf

Indices	T1	T2	T3	T4	T5	SL	P value
PCV (%)	41.33±7.57	41.00±18.08	37.67±13.58	43.00±4.58	47.67±13.58	NS	0.90
Hb (g/dl)	12.20±1.84	12.40±5.61	11.30±4.55	12.93±1.17	14.13±4.34	NS	0.92
TWBC (x10 ^{9}/L)	8.97±3.47^{ab}	7.93±4.74^{ab}	6.60±3.01^{ab}	2.73±1.08^{b}	10.90±3.21^{a}	S	0.11
N (%)	55.30±3.79^{b}	74.00±8.54^{a}	63.33±12.66^{ab}	51.00±6.08^{b}	48.67±13.43^{b}	S	0.51
L (%)	36.00±2.00^{a}	18.67±9.02^{b}	31.67±8.50^{ab}	45.33±7.23^{a}	41.33±8.96^{a}	S	0.01
M (%)	6.33±2.08	4.00±3.61	2.00±3.46	2.00±1.00	7.00±1.73	NS	0.11
E (%)	3.00±1.41	0.00±0.00	2.00±1.41	2.50±0.71	4.00±2.83	NS	0.72
RBC (x10^{12}/l)	5.91±0.81	6.13±2.67	5.60±1.81	6.53±0.56	6.85±1.92	NS	0.91
MCV(fl)	69.33±3.22	66.67±1.53	66.67±2.08	66.00±1.73	69.33±3.06	NS	0.33
MCH(pg)	20.67±0.58	20.00±1.00	20.00±1.73	23.00±6.08	37.00±29.74	NS	0.48
MCHC(g/dl)	30.00±1.00	30.00±1.00	29.00±1.53	30.00±0.00	26.33±5.50	NS	0.41
Platelet (x10^{9}/l)	244.33±62.07^{a}	155.00±50.03^{b}	218.00±49.57^{ab}	183.33±28.45^{ab}	180.67±22.9^{ab}	S	0.20

ab means on the same row with different superscripts are significantly different (p<0.05)
N – Nuetrophil; L – Leukocytes; M – Monocytes; E – Eosinophils; RBC – Red Blood Cells; MCV – Mean Cell Volume; MCH – Mean Cell Haemoglobin; MCHC – Mean Cell Haemoglobin Count

The result of the blood chemistry of rabbits fed plantain leaf is presented in Table 5. There were no altered effect (P>0.05) of the treatments on values of serum biochemical characteristics except for urea, glucose, sodium and potassium which had significant effect (P<0.05). The values for urea were within the range obtained in temperate regions (4.6-10.4 mmol/l) reported by (23) but higher in T1, T4 and T5 for the range (2.50 – 5.80 mmol/l) reported by (24).

Table 5: Serum biochemical indices and electrolytes of rabbits fed plantain leaf

Indices	T1	T2	T3	T4	T5	SL	P
Urea (mmol/L)	7.67±2.05^{a}	4.07±0.21^{b}	4.87±1.70^{ab}	7.73±2.76^{a}	6.40±0.89^{ab}	S	0.99
Creatinine (μmol/l)	69.67±26.16	74.33±9.87	91.00±6.56	76.00±25.94	90.00±6.56	NS	.054
Glucose (mmol/L)	8.87±3.49^{ab}	8.9±3.94^{ab}	6.50±6.01^{b}	4.37±0.76^{b}	17.07±6.92^{a}	S	0.67
ALT (Iu/l)	10.67±7.23	12.00±6.08	8.67±4.16	9.67±7.37	4.00±1.73	NS	0.52
AST (Iu/l)	10.00±1.00	14.00±4.36	16.00±1.73	15.00±7.81	13.67±2.31	NS	0.51
ALP (Iu/l)	126.00±33.78	131.67±38.66	105.67±1.53	102.67±3.22	111.33±14.05	NS	0.52
Na^{+}	153.67±11.59^{a}	142.67±6.03^{ab}	136.00±3.51^{b}	133.67±0.58^{b}	135.00±3.00^{b}	S	0.15
K^{+}	7.90±1.83^{a}	5.37±1.37^{b}	5.47±0.76b	4.10±1.21^{b}	6.47±0.74^{b}	S	0.03
Cl^{+}	101±3.61	100.00±4.36	99.33±2.89	97.33±2.52	99.67±1.15	NS	0.69
HCo_3^{-}	15.00±4.36	13.37±3.73	18.00±1.73	16.67±2.08	15.00±2.00	NS	0.42
Ca^{+}	2.60±0.27	2.57±0.15	2.47±0.32	2.50±0.10	2.87±0.15	NS	0.24

abc means on the same row with different superscripts are significantly different ($p<0.05$)
SL – Significant Level, ALT - alanine amino transferase, AST- aspartate amino transferase, ALP - alkaline phosphatase

The values obtained for glucose in this study was below that reported by (25) of 57-150.67 for rabbits fed Garcinia kola seed meals. The results for sodium and potassium showed significant difference ($P<0.05$) amongst treatments except chloride, carbonate and calcium which were similar ($P>0.05$). The Na, K values reported here is higher than those reported by (26) while that of calcium (Ca) was lower than the range of 5.3-10.0 mmol/L obtained by (26). High content of minerals might have caused the elevations of the serum minerals (26).

Table 6 shows lipid profile of rabbits fed plantain leaf. Apart from total cholesterol, other serum lipid profile assessed showed no significant difference ($P>0.05$) as seen in high density lipoprotein cholesterol (HDL), low density lipoprotein cholesterol and triglyceride.

Table 6: Serum lipid profile of rabbits feed plantain leaf

Parameters	T1	T2	T3	T4	T5	SL	P
Total cholesterol (mmol/L)	1.94±0.13^{a}	0.76±0.33^{c}	0.92±0.21^{bc}	1.54±0.38^{ab}	1.41±0.60^{abc}	S	0.01
HDL (mmol/L)	0.60±0.33	0.63±0.21	0.79±0.34	0.69±0.15	0.75±0.46	NS	0.86
LDL (mmol/L)	0.78±0.23	0.55±0.30	0.58±0.26	0.78±0.13	0.62±0.22	NS	0.63
Triglyceride (mmol/L)	0.94±0.62	1.13±0.42	0.95±0.15	0.57±0.47	1.40±0.47	NS	0.32

abc means on the same row with different superscripts are significantly different ($p<0.05$)
SL – significant Level, HDL – High Density Lipoprotein, LDL – Low Density Lipoprotein

Least cholesterol value (0.76 ± 0.33) was obtained for animals on T2 while control had the highest (1.94 ± 0.13) ($P<0.05$). The values for cholesterol obtained in this study was lower than the range reported by (19) of 3.62 – 4.11mmol/L for rabbits fed moringa leaf meal. The results obtained for most haematolgoical and serum biochemical parameters examined

in this study fall within their normal physiological ranges for rabbits (27).

Conclusion and Application

1. The results of the study have shown that plantain (*Musa paradiasica*) leaf did not adversely affect the growth performance, haematology and serum biochemistry of rabbits.
2. It is thus recommended as a veritable feedstuff for rabbits especially during the dry season and further research should be conducted by incorporating it in a concentrate feed formulation as a meal.

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