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Comparison of the Performance, Haematology and Serum Chemistry of Rabbits fed Supplementary Antibiotics and *Leucaena leucocephala*

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ABSTRACT

A comparison of four nutrition-based strategies to improve rabbit performance and health was the objective of this study. Two antibiotics: tylosin and Neoteramycin at 100 mg kg^{-1} and Leucaena leucocephala forage served fresh at 50 g/day were added to experimental diets for rabbits. The control diet contained neither antibiotic nor forage supplement, and each diet was fed ad libitum to ten individually caged rabbits for 70 days. Performance of rabbits was determined weekly, while haematology and blood chemistry were determined terminally. The results showed that all the rabbits fed the supplements had superior ($P<0.05$) growth rate, feed intake and feed conversion to the control group. The haemoglobin concentration, haematocrit and leucocytes were highest ($P<0.05$) in rabbits fed Leucaena leucocephala forage followed by antibiotic supplement and lowest in the control. Activities of aspartate and alanine amino transferase were highest ($P<0.05$) in the leucaenea fed rabbits followed by neoteramycin and tylosin respectively and lowest in the control group. The same trend was paralleled by results on total protein, albumin, globulin and creatinine. These data suggest that all the supplements have growth promoting effects in rabbits and differently modulate the blood chemistry. However, feeding supplemental leucaena forage is highly recommended since it neither contains chemicals nor antibiotics.

Key words: *Rabbits, serum chemistry, additives, antibiotics*

Running Title: Supplemental leucaena or antibiotics on performance of rabbits.

INTRODUCTION

The astounding rate at which world population is increasing and its attendant pressure on available food and feed resources warrants continuous scientific investigations into more efficient use of the available resources capable of boosting performance and productivity of livestock to meet human needs at reasonable cost. While ruminants and pigs can provide more bulk meat per animal, their gestation period and growth rates make the faster growing poultry and rabbits better options for accelerated animal protein supply. Rabbits hold unique position in developing countries in bridging the animal protein supply gap. Rabbits have been appropriately termed "micro-livestock" (Vietmeyer, 1985) for their highly efficient ability to digest high roughage diets, high fertility rate, early maturity and optimum feed efficiency. Good balance of nutrition has marked effects on haematology (Ologhobo *et al* 1986) and blood chemistry (Pant *et al* 1968). Feed additives as growth enhancers have become more important in nutrient metabolism and researchers have investigated various possible additives ranging from probiotics such as yeast (Onifade, 1997, Onifade *et al*, 1999), enzymes

(Partridge *et al*, 1998), amino acids (Braude *et al*, 1972) and herbs and herbal extracts (Best, 2000). A persistently recurring cycle in animal production is bacterial contamination of feeds and feed ingredients leading to infection in the livestock and depressed growth. Coupled with this is the high ambient temperature and humidity in the tropics conducive for bacterial growth. Antibiotics added to feeds at low levels help to reduce infection and stimulate growth (Hyden, 2000) and many of the possibilities for feed adjustment have been uncovered by several researchers who found benefits in their use (Bradley *et al*, 1994). *Leucaena leucocephala*, a tropical leguminous shrub is a major pasture plant in Nigeria and has been identified as a protein rich forage for ruminants (Hill, 1971, Oakes1968) but due to its toxicity at higher concentrations as protein supplement for swine (Adejumo and Akpokodje, 1990) and rabbits (Cheeke, 1986). This study investigates dietary formulations incorporating two proprietary antibiotics; tylosin and neoteramycin and *Leucaena leucocephala* forage as feed supplements for rabbits.

MATERIALS AND METHODS

Forty, 6 to 8 weeks old New Zealand White rabbits with average weight of 602g were balanced for weight and randomly allocated to four dietary treatments in individual cages and managed intensively for 70 days. The four diets were formulated as shown in Table 1. The first diet (**T1**) was the control and did not contain any antibiotics supplement or leucaena forage. Treatments **T2** and **T3** had the same dietary composition as the control but with 100 mg kg^{-1} tylosin and neoteramycin respectively. Diet **T4** had the same composition as **T1** but the rabbits were in addition fed *Leucaena leucocephala* forage served fresh at 50 g/day. Table 2 shows the proximate analysis of the basal (control) diet. The experiment lasted 70 days during which the feeds and water were provided *ad libitum*. The test diets were individually weighed for each rabbit three times a week and remnants scrapped out and weighed to determine weekly feed intake. Body weight gain and feed conversion were also determined on a weekly basis. At the end of the experiment, the animals were terminally bled for haematology and serum chemistry.

Packed cell volume (PCV), red blood cell count (RBC), white blood cell (WBC) and haemoglobin concentration were determined by Wintrobe's microhaematocrit, improved Neubauer haemocytometer and cyanometaemogblobin methods respectively. Mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC) were calculated as described by Jain, (1986).
Serum metabolites were assayed by standard colorimetric methods using Sigma kits (Harris, 1995, Moss and Henderson, 1999).

The proximate analyses of the diets were carried out according to procedures established by AOAC (1990) and the test results were analysed by analysis of variance (ANOVA) and means compared by the Duncan's multiple range test (Daniel, 1995).

RESULTS

The results of the performance indices are displayed in Table 3. Rabbits on leucaena forage consumed more feed ($P<0.05$) than the rabbits on the other diets which had similar feed consumption. Antibiotics supplements boosted feed intake compared with control but the improvement was not significant. The leucaena effect is maintained in the daily gain and final live weight. The data on the protein intake revealed higher protein intake in the leucaena supplemented rations which can be directly related to the high crude protein content (16.33%) of fresh leucaena forage. In spite of these effects, the rabbits on the control diet and the antibiotics supplement had better feed conversion and protein efficiency than leucaena supplemented diets. The blood picture is presented in Table 4. Significantly higher PCV, RBC and MCV were observed in rabbits on leucaena supplement while MCH and MCHC did not present a consistent trend. The leukocyte count was however higher ($P<0.05$) in the leucaena and the control groups than the other groups. The data on serum chemistry is summarized in Table 5. Total protein was highest ($P<0.05$) in the antibiotics fed group followed by the leucaena group and least in the control. The trend was somewhat reversed for the other parameters. Highest concentrations ($P<0.05$) of albumin, glucose, AST and ALT were recorded in the leucaena group followed by the antibiotics group and lowest in the control. In most of these parameters there were no significant differences between tylosin and neoteramycin supplementation.

DISCUSSION

The higher performance associated with the leucaena supplemented group can be traced to the higher protein intake of rabbits fed the forage. This also partly accounts for the heavier final weights and healthier haematological parameters observed in rabbits in the group. Ologhobo *et al* (1986), Babatunde and Pond, (1987), had established positive relationship between nutrition and blood quality. Therefore, the higher PCV, RBC, MCV and MCH recorded in the leucaena fed group is evident of the better nutrient quality of leucaena supplemented diets for rabbits. The average values recorded in the antibiotics supplemented diets also reinforced the results of Onifade, (1997) who observed better feed intake and absorption rate with antibiotics supplements due to their well known actions on the digestive tract and reduction of intestinal microorganisms. Not surprisingly therefore, WBC was highest in the leucaena group and lowest in the antibiotics supplemented group. In spite of the high consumption of the leucaena supplemented diet, the protein efficiency ratio of rabbits fed on it was inferior to the control and antibiotic supplemented diets. This is an interaction worth investigating further because of the direct relationship between protein efficiency and nutritive value of diets. The higher albumin and glucose levels of rabbits on leucaena supplemented diets can be linked to the earlier nutritive advantage of the higher protein and energy content of the leucaena forage. The toxicity of leucaena and the need for the detoxification of the anti-nutrient (mimosine) contained in it probably elicited the higher AST and ALT concentrations in the serum of the rabbits fed the diet. As these are primarily

liver enzymes, their elevation is an indication of liver activity (Onifade, 1999, Rosenthal, 1997) and further studies would be helpful in finding out the effects of concentration and duration feeding of low levels of leucaena supplement on rabbit serum chemistry to complement the copious data on leucaena in ruminant feeds. In summary, the study suggests that all the supplements have growth promoting effects in rabbits and differently modulate the blood chemistry. However, feeding supplemental leucaena forage is highly recommended since it neither contains chemicals nor antibiotics.

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Table 1. Formulation and Gross Composition of Experimental rations

Ingredients Gross Composition (%)	Treatments T1 (Control)	T2 Ration with tylosin at 100 mg Kg^{-1}	T3 Ration with neoteramycin at 100 mg Kg^{-1}	T4 Ration with leucaena leucocephala 50 g/ day
Maize	39.00	39.00	39.00	39.00
Groundnut Cake	12.00	12.00	12.00	12.00
Palm Kernel Meal	16.00	16.00	16.00	16.00
Maize offal	8.00	8.00	8.00	8.00
Dried Brewer's Grain	20.00	20.00	20.00	20.00
Blood Meal	2.4	2.4	2.4	2.4
Vitamin Premix	0.20	0.20	0.20	0.20
Oyster Shell	1.2	1.2	1.2	1.2
Bone meal	0.8	0.8	0.8	0.8
Salt	0.4	0.4	0.4	0.4
TOTAL	100.00	100.00	100.00	100.00
Supplements				
Tylosin	0.00	100 mg Kg^{-1}	0.00	0.00
Neoteramycin	0.00	0.00	100 mg Kg^{-1}	0.00
Leucaena leucocephala	0.00	0.00	0.00	50 g/ day

Table 2. Proximate Analysis of The Basal Diet

Component	(%)
Crude Protein	17.67
Crude Fibre	8.26
Ether Extract	2.68
Ash	8.38
Dry Matter	88.38
Gross Energy (KCal/Kg)	2667

Table 3. Performance Indices of Rabbits fed Antibiotics and Leucaena leucocephala Supplement

Parameters Gross Composition (%)	Treatments T1 (Control)	T2 Ration with tylosin at 100 mg kg^{-1}	T3 Ration with neoteramycin at 100 mg kg^{-1}	T4 Ration with leucaena leucocephala 50g/day	SEM
Initial Live Weight (g)	602.00	607.00	602.00	587.00	3.75
Final Live Weight (Kg)	1.49 ^{b}	1.52 ^{b}	1.52 ^{b}	1.61 ^{a}	0.023
Feed Intake (g/day)	61.25 ^{b}	68.01 ^{b}	69.00 ^{b}	85.00 ^{a}	4.36
Weight Gain (g/day)	15.83 ^{b}	16.27 ^{b}	16.30 ^{b}	18.3 ^{a}	0.48
Feed Conversion Ratio	3.87 ^{b}	4.18 ^{a}	4.23 ^{a}	4.64 ^{a}	0.01
Calculated Protein Intake (g/day)	10.82 ^{b}	12.02 ^{b}	12.19 ^{b}	20.08 ^{a}	1.83
Protein Efficiency Ratio	1.46 ^{a}	1.35 ^{a}	1.34 ^{a}	0.84 ^{b}	0.12

Values are means

Means across the same row differently superscripted differ significantly ($P<0.05$)

Table 4. Haematological Indices of Rabbits fed Antibiotics and Leucaena leucocephala Supplement

Parameters	Treatments				
Gross Composition (%)	T1 (Control)	T2 Ration with tylosin at 100 mg kg^{-1}	T3 Ration with neoteramycin at 100 mg kg^{-1}	T4 Ration with leucaena leucocephala at 50g/day	SEM
Packed Cell Volume (PCV) %	31.0 ^{b}	38.0 ^{a}	38.5 ^{a}	40.0 ^{a}	1.80
Haemoglobin (g/100ml)	9.71	10.25	10.70	11.97	1.08
Red Blood Cell ($x10^{6}$)	5.02 ^{b}	5.29 ^{b}	5.35 ^{b}	5.75 ^{a}	0.18
White Blood Cell ($x10^{3}$)	8.02 ^{a}	7.19 ^{b}	7.76 ^{b}	9.0 ^{a}	0.50
Mean Cell Volume (fl)	61.75 ^{b}	68.00 ^{a}	68.10 ^{a}	70.01 ^{a}	1.34
Mean Cell Haemoglobin (pg)	19.34 ^{b}	19.38 ^{b}	20.10 ^{a}	21.02 ^{a}	0.33
Mean Cell Haemoglobin Concentration (%)	31.32 $^{a\,b}$	33.31 ^{a}	30.01 ^{b}	30.02 ^{b}	0.67

Values are means
Means across the same row differently superscripted differ significantly ($P<0.05$)

Table 5. Performance Indices of Rabbits fed Antibiotics and Leucaena leucocephala Supplement

Parameters	Treatments				
Gross Composition (%)	T1 (Control)	T2 Ration with tylosin at 100 mg kg^{-1}	T3 Ration with neoteramycin at 100 mg kg^{-1}	T4 Ration with leucaena leucocephala 50g/day	SEM
Total protein (g/100ml)	5.9 ^{b}	8.40 ^{a}	8.55 ^{a}	7.98 ^{a}	0.39
Albumin (g/100ml)	4.03 ^{c}	4.35 ^{b}	4.36 ^{b}	4.78 ^{a}	0.13
Globulin (mg/100ml)	1.87	2.04	2.06	2.29	0.18
creatinine (mg/100ml)	1.89	1.73	1.78	1.98	0.06
Glucose (mgm100ml)	103	104	108	175 ^{a}	15.31
AST (iu/l)	70.5 ^{b}	72.2 ^{b}	73.4 ^{b}	78.02 ^{a}	1.00
ALT (iu/l)	67.2 ^{b}	68.4 $^{a\,b}$	68.5 $^{a\,b}$	71.4 ^{a}	0.77

Values are means
Means across the same row differently superscripted differ significantly ($P<0.05$)