EFFECT OF GRADED LEVELS OF FRESHLY HARVESTED BAMBOO LEAF (*Bambusa Arundinacea*) AND TRIDAX LEAF (*Tridax Procumbens*) MEALS ON THE HAEMATOLOGY OF RABBITS

Akinmoladun O.F[1]. and Sabi R.S.[2]

Department of Animal Science, Adekunle Ajasin University, Akungba-Akoko, Nigeria
Department of Animal and Environmental Biology, Adekunle Ajasin University, Akungba-Akoko, Nigeria.
Phone number/Email of corresponding Author: 07030793908/festykay123@gmail.com

Abstract

Graded levels of Bamboo and Tridax leaf meal were administered into the diet of growing rabbits to determine its effect on their haematological variables (PCV, RBC, WBC, Hb, MCV, MCH and MCHC). Thirty six (36) individually caged mixed rabbits (New Zealand White, Chinchilla and crosses) were randomly allocated to six treatments comprising of the control T1 (formulated feed alone), T2 (100%), T3(75%), T4(50%), T5(25%) and T6 (0%) bamboo leaf meal inclusion levels in a completely randomized design. Each treatment comprise of 6 rabbits. Results obtained showed that Haematological parameters such as the Pack Cell Volume (PVC), White Blood Cell (WBC), Platelets, Red Blood Cell (RBC), Haemoglobin (Hb), Mean Cell Haemoglobin Concentrate (MCHC), and Mean Cell Volume (MCV) were significantly different ($P<0.05$) among the rabbits across the treated groups. Mean Cell Haemoglobin (MCH) values showed no significant differences ($p>0.05$).The values for PCV suggested that the various levels of Bamboo leaf meal (BLM) used in this study had no toxic effect on the health status of the experimental animals. The non-elevated values of neutrophils and lymphocytes ratio suggest that the animals were clinically sound. Up to 100% of BLM in combination with formulated diet can thus be included in the diet of growing rabbits without any serious adverse effects on haematological characteristics.

Keywords: Growing rabbit, Bamboo leaf, Haematological parameters, Tridax leaf meal

Introduction

Rabbit which falls into the category of under-utilized livestock species in developing countries appears to be among the most suitable and sustainable means of producing high quality meat to combat animal protein shortage in the diet of people in developing countries. Their genetic merits include; high fecundity, low cost of investment, short generation interval (30-32 days), as well as the ability to utilize diverse forage (Taiwo *et al.*, 2005). Rabbit meat is also known to be low in fat, cholesterol, sodium and calorie (Dalle Zotte, 2000) but high in quality protein when compared to other livestock species (Nistor *et al.*, 2013). Although rabbits can survive on all forage diet, optimum performance can only be ensured in a mixed feeding regime involving forage and formulated feeds (Harries *et al.*, 1984; Cheeke *et al.*, 1987; Arijeniwa *et al.*, 2000). Bamboo (BAM) a non-leguminous multi-purpose tree, is one of the fastest growing trees in the world, with high crude protein in the leaves (> 20 %) (Makkar and Becker 1996; Nouala *et al.*, 2006), and offering a good alternative source of protein to ruminants wherever they thrive (Nouala *et al.*, 2006). Various species of bamboo have been reportedly used to feed livestock/ruminants. *Arundinaria racemosa* in the Himalayas (Lawson, 1968) and Arundinaria tecta (cane breaks) in North Carolina (Farrelly, 1984) have been evaluated for use as cattle fodder. Numerous bamboos are fed to horses, cattle and sheep worldwide (Farrelly, 1984).

The nutrition of Rabbit in Nigeria is primarily based on *Tridax procumbens* and/*or Centrosoma pubescens* where growth and availability in the dry season cannot sustain all year Rabbit production (Odeyinka *et al.*, 2007). Nutrients levels in blood and body fluids are considered to be proximate measures of longtime nutritional status (Doyle *et al.*, 2006). Therefore this study was carried out with the aim of assessing the Haematological variables of Rabbits fed Bamboo leaf meal as a replacement for *Tridax procumbens*.

Material and Methods

Experimental Animals, Diets and Management

The experiment was carried out at the Animal house, Animal and Environmental Biology Department, Adekunle Ajasin University, Akungba -Akoko, Ondo State. Thirty six mixed sex and heterogenous stocks of growing rabbits, about 5-6 weeks old were divided into 6 groups with each group containing 3buck and 3does. The groups were randomly assigned to 6 treatments diets:

Diets 1= 100% concentrate/formulated feed which serve as the control

Diets 2= 50% concentrate with 50% (100% Bamboo leaf meal (BLM)
Diets 3 = 50% concentrate with 50 %(75% BLM and 25% Tridax leaf meal (TLM)
Diets 4 = 50% concentrate with 50% (50% BLM + 50% TLM)
Diets 5 = 50% concentrate with 50% (25% BLM+75%TLM)
Diets 6 = 50% concentrate with 50% (100% TLM)
At the start of the experiment, the rabbit were weighed individually and assigned to six dietary treatments. The diets were analyzed for proximate composition. The rabbits were stabilized on the diets for one week before starting the experiment. The rabbits were weighed at the start of the experiment and on weekly basis thereafter. The animals were offered 4% of their body weight on dry matter basis daily (2% concentrate and 2% forage).
Feed intake and weight gain were taken weekly.
The experimental animals were housed each in a wooden hutch with a wire mesh floor (so that feaces and urine can drop) and window for ventilation. The condition of housing and management were same for all the experimental animals. These management techniques employed for all the experimental animals are as follows: Regular cleaning of the hutch with disinfectant. Feeding and watering of the experimental animals were on a daily basis. The animals were managed well for optimum performance. At the end of the feeding period (70 days), the animals were starved for 24 hours before blood samples were collected from 4 rabbits (that is, 2 bucks and 2 does per treatment) via neck slit/slaughtering, for haematological analysis. The blood samples were collected into bottles with ethylene diamine tetra-acetate (EDTA) as anti-coagulant for haematological indices as described by Lamb (1981). The experimental leaf meals were screened for phytochemicals according to the method described by Trease, (1989) and Sofowora, (1993).The proximate composition of experimental diets were determined according to the method described by AOAC (2000)

Statistical Analysis

All data on haematological variables were subjected to one way analysis of variance (ANOVA) using IBM SPSS Version 20.

Result and Discussion

The result of the composition of experimental basal diets, proximate composition of experimental diet and phytochemical screenings of leaf meals are shown in Table 1, 2 and 3 respectively. The result of the haematological variables and the erythrocytic indices of rabbit fed graded levels of bamboo leaf and *Tridax procumbens* are shown in the Table 4 and 5 respectively.
The values for pack cell volume (PCV) were significantly different ($p<0.05$) among the treated groups. T2 (100% bamboo leaf meal), T4 (50% bamboo leaf meal) and T6 (0% bamboo leaf meal) were not significantly different from each other and all fell within the range of normal healthy growing rabbits (Archetti *et al.*, 2008). Treatment T2 (100% bamboo leaf meal inclusion) gave the highest value and T1 the lowest. The values for PCV suggested that the various levels of Bamboo leaf meal (BLM) used in this study had no toxic effect on the health status of the experimental animals and agrees with the report of Sese and Igirigi, (2014) who fed young rabbits with various levels *of Mucuca utilis* leaf meal and recorded same report. Packed Cell Volume is involved in the transport of oxygen and absorbed nutrients.
There were significant differences ($p<0.05$) in the values for white blood cells (WBC's) among treated groups and all fell within the range of normal rabbits (Archetti *et al.*, 2008). Treatment T3 (75% bamboo leaf meal) had the highest value. It is probable that the higher WBC's at 75% BLM may be as a result of improvement in the immunological status of the animals (Princewill, 2008). WBC rise in rabbit rarely indicates an infection; it generally varies due to various stress factors and blood collection methods (Silva *et al.*, 2005, Melillo, 2007, Jenkins, 2008). Since the WBC fell within normal range among treated group, it is an indication that the defense systems were not affected negatively by the ingestion of bamboo leaf meal at graded levels. This agrees with the report of Timibitei *et al.* (2014) who fed rabbits with *Alchornea cordifolia* leaf meal and said that the WBC of rabbit is not compromised if they fall within the normal range of healthy rabbits. WBC's of animals vary between species, individual sex, environment and clinical conditions of the animal (Princewill, 2008). The major functions of the white blood cell and its differentials are to fight infections, defend the body by phagocytocis against invasion by foreign organisms and to produce or at least transport and distribute antibodies in immune response.
There were no significant differences ($p>0.05$) in the values for neutrophils and lymphocytes among treated groups and were within the range of normal healthy rabbits (Mitruska, and Rawnsley, 1977; Kerr, 1989; and Archetti *et al.*, 2008). The non-elevated values of neutrophils and lymphocytes ratio suggest that the animals were

Table 1: Composition of Experimental Basal Diets

Ingredients	Quantity
Maize	47.34
Wheat Bran	38.00
Soya Bean Meal	12.49
Bone Meal	1.12
Periwinkle	0.58
Salt	0.35
Premix	0.15
Total	100
Calculated Composition	
Crude Protein (%)	16.00
Metabolizable Energy (Kcal/Kg)	2400.00
Energy : Protein	150:1

Table 2: Chemical Composition of Experimental Diet

DIET	DM (%)	ASH (%)	EE (%)	CF (%)	CP (%)	NFE (%)
Concentrate	91.23	6.96	5.05	3.27	17.08	67.64
BLM	90.18	15.29	2.71	13.79	12.11	56.10
TLM	90.40	11.77	15.32	15.32	3.98	53.61

BLM- Bamboo leaf meal; TLM- Tridax leaf meal; DM-Dry Matter; EE-ether extract; CF- Crude fibre; NFE-nitrogen free extract

Table 3: Phytochemical Screening of Experimental Leaf Meals

Phytochemicals/ Parameters	Tannin	Alkaloid	Saponin	Cardiac glycosides	Terpenoids	Flavonoids
BLM	+	++	-	+	+	+
TLM	+	+	+	-	-	-

BLM- Bamboo leaf meal; TLM- Tridax leaf meal. **(+): Present, (++): highly present, (-): absent**

clinically sound, as reported by Princewill, (2008). The neutrophils are concerned with day to day immunological defense against pathogens. Lymphocytes kill cells that contain viruses. The values for monocytes did not fall within the normal range of healthy rabbits as reported by Mitruska, and Rawnsley, (1977) and Archetti *et al.*, (2008), but are within the normal range of healthy rabbits as reported by Kerr, (1989). There were significant differences ($p<0.05$) in the monocyte values among treated groups, the values for T5 (25%BLM) and T6 (0% BLM) were not significantly different ($p>0.05$) from each other. The values for basophils showed no significant differences ($p>0.05$) across treated groups and were found within the range for normal rabbits as reported by Kerr, (1989) and Archetti *et al.* (2008). Basophils appears during inflammation and enlists the help of stronger white blood cells, monocytes are precursors to macrophages which digest bacteria and virus. The low values of basophils and monocytes agrees with the statement that basophils and monocytes are normally present in small to moderate number in the peripheral blood system of rabbits (Bernischke *et al.*, 1987; Odeys, 1996). There were no significant differences ($p>0.05$) in the values of eosinophils and they fell within the normal range of healthy rabbits (Kerr, 1989; Archetti *et al.*, 2008).

The haematological indices (platelet) showed significant differences ($p < 0.05$) among treated groups. The values for T3, T5, and T6 were not significantly different ($p>0.05$) from each other. These values fell within the normal range for healthy rabbit according to Kerr, (1989), Mitruska and Rawnsley, (1977) and Archetti *et al.* (2008) with the exception of T1 (control) and T2 (100% BLM) which fell below the normal range of healthy rabbit as reported by Kerr, (1989), Mitruska and Rawnsley, (1977) and Archetti *et al.* (2008). Nevertheless, the values gotten were in agreement with the normal range of healthy rabbit as reported by Hewitt *et al.* (1989). Variations may probably be as a result of small sample size tested or platelet clumping in the blood of the rabbit tested (Hewitt *et al.*, 1989). Platelet work to form blood clots and prevent loss of too much blood when an injury is sustained and also help in wound healing. Blood platelets are implicated in blood clotting. Low platelet concentration suggests that the process of clot-formation (blood clotting) will

Table 4 Haematological Variables of Rabbits fed graded levels of freshly harvested *Bamboo* leaf and *Tridax* leaf

Erythrocytic indices	Unit		T1	T2	T3	T4	T5	T6
MCHC	%	24[1]	30.96±1.07[b 2]	31.28±0.74[ab]	32.14±1.17[ab]	31.98±1.77[ab]	32.19±0.75[ab]	33.03±0.97[a]
MCH	Pg	24	21.28±0.63	20.67±1.07	20.46±1.57	20.23±1.42	20.57±0.66	22.04±0.96
MCV	Fl	24	68.75±0.73[a]	66.14±4.12[ab]	58.60±13.04[b]	63.29±2.25[ab]	63.90±0.76[ab]	67.29±3.97[ab]

[a,b,c]: Means with different superscripts are significantly different ($p < 0.05$) from each other
T1: Complete / FF (100%), T2: 50% FF + 50(100% BLM), T3: 50% FF + 50% (75%BLM+25%TLM), T4: 50% FF+50% (50% BLM+50%TLM), T5: 50% FF+50 %(25%BLM+75%TLM), T6: 50% FF+50 %(100%TLM)
(FF): Formulated feed, (BLM): Bamboo leaf meal, (TLM): Tridax leaf meal

Table 5: Erythrocytic Indices of Rabbits fed graded levels of freshly harvest *Bamboo* Leaf and *Tridax* Leaf

Haematological Parameters	Units		T1	T2	T3	T4	T5	T6
Pack cell volume (PVC)	%	24[1]	27.50±7.14[b 2]	37.25±4.72[a]	31.50±4.04[ab]	34.75±3.30[a]	33.00±2.71[ab]	34.50±0.58[a]
White blood cell (WBC)	10^9	24	3.85±2.41[b]	4.75±1.46[ab]	6.38±1.18[a]	5.55±1.03[ab]	4.73±0.30[ab]	3.55±0.86[b]
Neutrophils	%	24	51.50±3.11	51.25±1.71	48.75±5.19	50.50±2.52	50.50±2.89	52.75±1.89
Lymphocytes	%	24	44.00±2.58	43.75±1.50	45.75±4.43	45.75±2.50	45.00±2.58	43.50±1.73
Monocytes	%	24	2.50±0.58[abc]	2.75±0.96[ab]	3.25±0.96[a]	1.50±0.58[c]	1.75±0.50[bc]	2.00±0.00[bc]
Eosinophil	%	24	1.25±0.50	1.25±0.50	1.25±0.50	1.25±0.50	1.75±0.50	1.00±0.00
Basophils	%	24	0.75±0.50	1.00±0.00	1.00±0.00	1.00±0.00	1.00±0.00	0.75±0.50
Platelet	10^9	24	189.25±129.30[b]	196.50±138.37[b]	325.75±74.09[ab]	405.75±92.06[a]	306.75±74.75[ab]	287.75±143.77[ab]
Red blood cell (RBC)	10^{12}	24	4.01±1.07[b]	5.79±0.72[a]	4.95±0.49[a]	5.49±0.38[a]	5.17±0.46[a]	5.10±0.29[a]
Haemoglobin (HB)	g/ld	24	8.55±2.42[b]	11.98±1.63[a]	10.13±1.34[ab]	11.13±1.35[a]	10.63±0.96[ab]	11.23±0.33[a]

[1]Number of animals; [2]Mean and standard deviation
[a,b,]: Means with different superscripts are significantly different ($p > 0.05$) from each other
T1: Complete / FF (100%), T2: 50% FF + 50 %(100% BLM), T3: 50% FF + 50% (75%BLM+25%TLM), T4: 50% FF+50% (50% BLM+50%TLM), T5: 50% FF+50 %(25%BLM+75%TLM), T6: 50% FF+50 %(100%TLM)
(FF): Formulated feed, (BLM): Bamboo leaf meal, (TLM): Tridax leaf meal
(MCHC): Mean Cell Haemoglobin Concentrate,
(MCH): Mean Cell Haemoglobin,
(MCV): Mean Cell Volume

be prolonged resulting in excessive loss of blood in the case of injury.

The red blood cells (RBC's) recorded among treated groups in this study showed significant differences ($p<0.05$) and were within the recommended range as reported by Kerr, (1989), Archetti *et al.* (2008) for healthy rabbits. The values for T2-T6 were not significantly different from each other. Genetic factors such as breed and genotype have been reported to influence RBC values (Chineke *et al.*, 2006). Red blood cell is involved in the transport of oxygen and carbon dioxide in the body. Thus, a reduced red blood cell count implies a reduction in the level of oxygen that would be carried to the tissues as well as the level of carbon dioxide returned to the lungs.

The haemoglobin values showed significant differences ($P<0.05$) among treated groups and fell within normal range of healthy rabbits (Mitruska, and Rawnsley, 1977; Kerr, 1989; and Archetti *et al.*, 2008), with the exception of T1 which fell slightly below the normal range of healthy rabbits as reported by Kerr, (1989), Mitruska and Rawnsley, (1977) and Archetti *et al.* (2008). This variation may be due to genetic factors such as the breed as reported by Chineke *et al.* (2006), since different breeds of rabbits were also used in this study. T2 and T6 were not significantly different ($p>0.05$) from each other.

There were significant differences ($p<0.05$) in the

mean cell haemoglobin concentrate (MCHC) among treated groups and they are also within the normal range of healthy rabbits (Kerr, 1989; Mitruska, and Rawnsley, 1977). The MCHC values have been shown to be the most accurate and absolute values that indicate anaemic condition in animals (Thompson, 2006). Since MCHC values were within normal range of healthy rabbit among treated groups, this suggests that all the rabbits irrespective of the diets had normocytic and normochromic red cell, meaning that the animals did not suffer normocytic anaemia (Thompson, 2006).

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