Nig. J. Anim. Prod. 2018, 45(5):30 - 38
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Nigerian Journal of Animal Production

Evaluation of haematology and serum biochemistry of weaner rabbits fed diets containing *Ficus sycomorus* and *Parkia biglobosa* leaf meals

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Abstract

A study was conducted to investigate the effect of varying levels of Ficus sycomorus and Parkia biglobosa leaf meals based diets on the haematology and serum biochemistry of weaner rabbits. Twenty rabbits of mixed breed and sex were allotted to four treatments with each treatment consisting of five rabbits per treatment. The treatments consisted of diets with zero forage (T_1; control), 5% Ficus sycomorus leaf meal (T_2), 5% Parkia biglobosa leaf meal (T_3) and 2.5% Ficus sycomorus + 2.5% Parkia biglobosa leaf meals (T_4) in a completely randomized design. The diets were iso-nitrogenous and the trial lasted for eight weeks. Haematological parameters measured were PCV, Hb, RBC, WBC, MCV, MCH and MCHC whereas total protein, albumin, globulin, glucose, urea and cholesterol were the biochemical parameters measured. Result of the study showed that Ficus sycomorus and Parkia biglobosa leaves were high in DM, CP, CF, fat and ash contents (94.50% and 92.30%, 18.66% and 19.60%, 9.32% and 7.12%, 9.71% and 8.00%, 10.46% and 12.60%, respectively) but low in moisture (5.50% and 7.70%, respectively). It also revealed significant differences ($P<0.05$) in all parameters evaluated for haematology [31.93 - 41.90% PCV, 9.50 - 12.10 g/dL Hb, (4.13 - 5.93) x 10^6/mm^3 RBC, (1.71 - 5.80) x 10^6/mm^3 WBC, 70.67 - 77.37 Fl MCV, 20.46 - 23.96 Pg MCH and 29.00 - 30.00% MCHC]. The values of total protein (68.00 - 74.00 g/L), albumin (34.00 - 48.33d/L), globulin (25.67 - 34.00g/L), glucose (3.67 - 4.57 mmol/L), urea (8.73 - 9.67 mg/dL) and cholesterol (1.17 - 2.60 mmol/L) obtained for biochemical parameters in the control and study animals also showed significant ($P<0.05$) differences except for globulin. It was concluded that inclusion of Ficus sycomorus leaf meal in the diets of weaner rabbits at 5% had no adverse effect on the parameters evaluated. It was therefore, recommended that 5% inclusion level of Ficus sycomorus could be safely incorporated in the diets of weaner rabbits to meet their protein requirements as an alternative to more expensive conventional protein sources.

Keywords: *Ficus sycomorus*, *Parkia biglobosa*, rabbit, haematology, serum biochemistry

Introduction

Rabbits are small herbivores that have digestive tracts that enable the efficient utilization of high levels of roughage and forage materials (Obioha, 1998) thereby reducing the pressure on cereal grains and pulse (legumes) as sources of energy and protein respectively (Alade *et al*., 2001). The heavy and increasing reliance on soybean meal, fish meal and other conventional sources of protein for animal feeding (FAO, 2004) has led to high costs of conventional feeds especially in developing countries (Alade *et al*., 2001). Numerous species of trees of protein origin are under-utilized, some of which may have promising and desirable nutritive quality for inclusion in animal diets. Among these trees are *Ficus sycomorus* and *Parkia biglobosa* which may have high potentials in rabbit feeding by providing proteins, minerals and vitamins that are lacking in grassland pastures (Bamikole *et al*., 2001). Blood is the major transport system of the body and its constituents change in relation to the physiological conditions of the

animals (Ihedioha *et al.*, 2004). Haematological study is a useful tool for the diagnosis of many diseases and investigation of the extent of damage to the blood (Onyeyihi *et al*., 1991). Serum biochemical analysis is used to determine the level of heart attack, liver and kidney damage (Harper *et al*., 1999). Thus, the objective of this study was to evaluate haemotological and serum biochemical parameters of weaner rabbits fed diets containing forage leaf meals as a source of protein.

Materials and methods

Experimental location

The experiment was carried out at the Livestock Teaching and Research Farm, Federal University Dutse, Nigeria. Dutse is located on longitude 9.34^{0}E and latitude 11.76^{0}N and has an elevation of 431.36 meters above sea level (Encarta, 2007). There is usually a hot diurnal temperature and comparatively cooler nights during the last 2-3 months of the dry season which is followed by a wet season between the months of June and September (Wikipedia, 2013).

Processing of experimental materials

Fresh leaves of *Ficus sycomorus* and *Parkia biglobosa* were harvested, air dried for some days until they became crispy and milled using a hammer mill to produce *Ficus sycomorus* and *Parkia biglobosa* leaf meals.

Experimental stock and their management

Twenty rabbits between six and seven weeks of age, of mixed breed and sex, were randomly divided into four experimental groups of five rabbits each. The four treatment groups were assigned the four experimental diets in a completely randomized design. Each rabbit received an assigned diet for eight weeks; the rabbits were provided with feeders and drinkers and were quarantined for 21 days before the commencement of the experiment. Prior to the experiment, they were dewormed and given accaricides bath.

Experimental diets

Four diets were formulated with treatment one (T_1) serving as the control, thus did not contain the test ingredients. The dietary treatments contained the following inclusion levels of the forage leaf meals; 0% forage meal, 5% *Ficus sycomorus* leaf meal, 5% *Parkia biglobosa* leaf meal and 2.5% *Ficus sycomorus* + 2.5% *Parkia biglobosa* leaf meals as T_1, T_2, T_3 and T_4, respectively as presented in Table 1.

Table 1: Composition of the experimental diets (%)

	Treatments			
Ingredients	**T_1**	**T_2**	**T_3**	**T_4**
Maize	51.60	47.74	47.88	47.80
SBM	14.90	13.76	13.62	13.71
FLM	0.00	5.00	0.00	2.50
PLM	0.00	0.00	5.00	2.50
W/Offal	30.0	30.0	30.00	30.0
Bone Meal	3.00	3.00	3.00	3.00
Salt	0.25	0.25	0.25	0.25
Premix	0.25	0.25	0.25	0.25
Total	**100**	**100**	**100**	**100**
Calculated ME (Kcal)	2692	2532	2533	2533
Calculated Protein (%)	16.84	16.83	16.75	16.80

SBM=Soyabean Meal, FLM= *Ficus sycomorus* Leaf Meal, PLM = *Parkia biglobosa* Leaf Meal, W/Offal=Wheat Offal, ME=Metabolizable Energy, CP=Crude Protein, T_1=0% forage, T_2=5% FLM, T_3=5% PLM, T_4=2.5% FLM + 2.5% PLM.

Blood analysis

Blood samples (5 mL) were drawn from each rabbit on the last day of the study. The rabbits were bled through the ear marginal vein. About 2.5 mL was collected in labelled sterile universal bottle containing 1.0 mg/mL ethyldiamine tetra acetic acid for haematological analysis and another 2.5 mL was collected in anti-coagulant free bottle for serum biochemical analysis. Serum biochemistry and haematological parameters were measured using Beckman Coulter Ac-T10 Laboratory Haematology Blood Analyzer and Bayer DCA 2000+ HbA1c analyzer, respectively. Mean corpuscular haemoglobin (MCH), mean corpuscular volume (MCV) and mean corpuscular haemoglobin concentrations (MCHC) were calculated.

Chemical analysis

Samples of *Ficus sycomorus* and *Parkia biglobosa* leaves were milled using a 2.0mm sieve and analyzed for proximate composition as outlined by AOAC (1999).

Data analysis

The data were analyzed using completely randomized design of SAS (1999) Statistical Package and differences between means were separated using Least Significant Difference (LSD).

Results and discussion

The results of the proximate composition of *Ficus sycomorus* and *Parkia biglobosa* leaf meals are presented in Table 2. *Ficus sycomorus* and *Parkia biglobosa* leaf meals were found to be high in dry matter (94.50% and 92.30% respectively), crude protein (18.66% and 19.60% respectively), crude fibre (9.32% and 7.12% respectively), fat (9.71% and 8.00% respectively) and ash (10.46% and 12.60% respectively) but low in moisture (5.50% and 7.70% respectively). The values obtained for crude protein are above the 7% protein requirement for optimum microbial growth in the rumen and falls within the crude protein requirement of 15-18% for growing sheep (ARC, 1990).

Table 2: Proximate composition (%) of *Ficus sycomorus* and *Parkia biglobosa* leaf meals

Measurements	FLM	PLM
Dry Matter	94.50	92.30
Moisture	5.50	7.70
Crude protein	18.66	18.40
Crude fibre	9.32	7.12
Fat	9.71	8.00
Ash	10.46	12.60

FLM = *Ficus sycomorus* leaf meal, PLM = *Parkia biglobosa leaf meals*

*Standard methods of A.O.A.C. (1999) were used to determine the proximate composition.

Table 3 shows the haematological response of the experimental animals fed the treatment diets. Packed cell volume was significantly ($P<0.05$) higher for T_2 (41.90%) compared to the other treatments. Significantly ($P<0.05$) higher values of haemoglobin were obtained in T_2 and T_3 while lower values were obtained in T_1 and T_4. Value obtained for red blood cell was significantly ($P<0.05$) higher in T_2 ($5.93x10^6/mm^3$) compared to other treatments while T_4 ($1.17\ x10^6/mm^3$) had significantly ($P<0.05$) lower value of white blood cell. The MCV, MCH and MCHC obtained differed significantly ($P<0.05$) between the treatments with higher values obtained in T_1 (control). PCV values (31.93 - 41.90%) reported in this study fell within the range of 31.33 - 36.83% and 31.62 - 36.59% reported by Ibrahim *et al.* (2014) and Jiwuba *et al.* (2016), respectively except for T_2 (5% *Ficus sycomorus*) which was slightly higher. The PCV obtained compared favorably with the reports of

Bradley (2001) for healthy rabbits. Hb (9.50-12.10g/dl) values obtained were in agreement with the reports of Bradley (2001) and Ibrahim *et al.* (2014) but lower than reported values of 12.90 – 14.00 g/dl by Ogbuewu *et al.* (2010) for rabbits fed different levels of neem (*Azadirachta indica*) leaf meals. Values obtained for red blood cells were in agreement with the range (3.60-5.20) x 10^6/mm^3 reported by Ogbuewu *et al*. (2010) except T_2 which was slightly higher signifying that the experimental animals were not susceptible to anaemia related diseases. Haematological traits especially PCV and Hb have correlation with the nutritional status of animals (Adejumo, 2004). Adamu *et al.* (2006) stated that nutrition had significant effect on haematological values, while Etim *et al.* (2014) reported that stress due to nutrition or other factors are determined using changes in haematological parameters. The values of PCV, Hb and RBC observed in this study signified that inclusion of *Ficus sycomoros* and *Parkia biglobosa* leaf meals in the diets of the rabbits had no detrimental effects on them and did not subject the animals to nutrition-related stress as evident from the results obtained. Phagocytic function is carried out by white blood cells in animals (Campbell and Coles, 1986). White blood cell (WBC) lower than normal indicates a greater challenge to the immune system (Etim *et al.,* 2014) and also suggests a decline in the production of defensive mechanism to combact infection (Eheba *et al.,* 2008) whereas higher than normal WBC suggests disease resistance (Nwosu, 1979). WBC (1.71-5.80) x 10^6/mm^3 reported in the present study was in agreement with the report of Annon (1980) for rabbits except for T_4 (2.5% *Ficus sycomorus* + 2.5% *Parkia biglobosa* leaf meal) and T_1 (0% Forage) which were slightly below the range. Thus, with the exemption of T_4 and T_1, it probably implies that all the experimental animals produced adequate defensive mechanism to combact infection. The low value of WBC obtained in T_4 could be attributed to the high level of forage inclusion in the diet, as Bawala *et al.* (2007) stated that low haematological values could be due to harmful effects of high dietary content. Values obtained for MCV (70.67-77.37 Fl) were slightly higher than the values (60-69 Fl and 59-67 Fl) reported by Jenkins (2006) and Gillet (1994), respectively. MCH value (20.46-23.96 Pg) observed in this study agreed with the work of Benson and Paul-Murphy (1999) and Gillet (1994); also, the values obtained for MCHC (29.00-30.00%) fell within the range reported for rabbits by Jenkins (2006) and Gillet (1994). According to Njidda *et al.* (2006), MCV, MCH and MCHC are used in diagnosing anaemic conditions and therefore, are important morphological characteristics of anaemia (Campbell, 1988). Perhaps, this is an indication that the rabbits were not anaemic.

Table 3 : Haematological indices of weaner rabbits fed varying levels of *Ficus sycomorus* and *Parkia biglobosa* leaf meals

	Treatments				
Parameters	T_1	T_2	T_3	T_4	LSD
Packed Cell Volume (%)	31.93^b	41.90^a	34.30^b	32.70^b	3.89
Haemoglobin Concentration (g/dL)	9.90^b	12.10^a	10.30^a	9.50^b	11.26
Red Blood Cells (x 10^6/mm^3)	4.13^b	5.93^a	4.45^b	4.48^b	0.66
White Blood Cells (x 10^6/ mm^3)	2.99^{bc}	5.80^a	4.39^{ab}	1.71^c	1.71
Mean Corpuscular Volume (Fl)	77.37^a	70.67^b	72.67^{ab}	72.97^{ab}	5.82
Mean Corpuscular Haemoglobin (Pg)	23.96^a	20.46^b	21.73^b	21.40^b	1.92
Mean Corpuscular Haemoglobin Concentration (%)	30.00^a	29.00^c	29.67^b	29.33^b	4.31

a, b, c = Means in the same row having different superscripts differ significantly ($P< 0.05$), T_1 = 0% forage, T_2= 5% *Ficus sycomorus* leaf meal, T_3 = 5% *Parkia biglobosa* leaf meal, T_4 = 2.5% *Ficus sycomorus* + 2.5% *Parkia biglobosa* leaf meals, LSD=Least Significant Difference

Results of serum biochemical indices of weaner rabbits fed the treatment diet are presented in Table 4. Significantly ($P<0.05$) higher values of total protein (74.00g/L) were obtained in T_1 and T_2 while lower values (68.00g/L) were obtained in T_3 and T_4. T_1 (control) had significantly ($P<0.05$) higher value of albumin (48.33g/L) whereas globulin did not show any significant ($P>0.05$) difference across the treatments. Glucose, urea and cholesterol had significantly ($P<0.05$) higher values in T_1 (4.57mmol/L), T_3 (9.67mg/dL) and T_4 (2.60mmol/L) respectively. Total protein (68.00 – 74.00 g/L) in the serum of the rabbits in all the treatments were in agreement with the reports of Gbore and Akele (2010) in their study of the growth performance, haematology and serum biochemistry of female rabbits (*Oryctolagus cuniculus*) fed dietary fumonisin. Total protein values were also within the range of 54-75 g/L and 5-8 g/dL reported by Jenkins (2006) and Mitruka and Rawnsley (1977), respectively for healthy rabbits which is an indication of the nutritional adequacy of dietary proteins since serum protein synthesis is related to the amount of available protein in the diet (Iyayi and Tewe, 1998). The range of values obtained for albumin (34.00 - 48.33g/L) was in line with the reports of Annon (1980) and Medirabbit (2011) for healthy rabbits insinuating that there was no alteration in the normal systemic protein utilization as well as the proper functioning of the liver (Jiwuba *et al.,* 2016). Similarly, the result of serum globulin (25.67 - 34.00 g/L) was in agreement with the findings of Burke (1994) who reported a range of 1.5 - 3.3 g/dL for healthy rabbits. This revealed that the experimental animals had good resistance to disease and a corresponding high immunity (Jiwuba *et al.,* 2016). The high values of total protein and albumin, and the non-significant value obtained for globulin in the sera of rabbits on T_2 implies that the protein were adequately synthesized in the animals compared with the rabbits on T_3 and T_4. Wafar *et al.* (2014) reported a range of 31.37 - 38.00 mg/dL urea in their study of the effect of processing methods of *Leptadenia hastata* leaves on haematology and serum biochemistry of weaner rabbits. A range of 30.96 - 35.40 mg/dL urea was also reported by Jiwuba *et al.* (2016) for weaner rabbits fed varying levels of dried *Gmelina arborea* leaf meal. Urea values obtained in this study were lower than reported values. The low serum urea content of rabbits in this study especially those on T_2 with 5% *Ficus sycomoros* leaf meal suggests that the diets were rich in protein and the protein was of high quality, as high urea level is an indication of low protein quality (Esonu *et al.,* 2001). A low urea level also insinuates that the protein rich diet enhanced the proper functioning of the kidneys (Henry *et al.,* 2017). Cholesterol values (1.17 - 2.60 mmol/L) obtained were within the normal physiological range for rabbits (0.5 - 4.4 mmol/L) reported by Bradley (2001). Cholesterol content in the sera of rabbits on all the treatments compared favorably with the range of 2.14 ± 0.60 - 3.31 ± 0.97 mmol/l reported by Rupic *et al.* (1999) for rabbits fed different quantities of dried olive cake. T_2 had the least cholesterol (1.17mmol/L) which may suggest that the diet would assist in reducing the deposition of cholesterol in the muscle, consequently producing lean meat.

Table 4: Serum Biochemical Indices of rabbits fed varying levels of *Ficus sycomorus and Parkia biglobosa* leaf meals

	Treatments				
Parameters	**T_1**	**T_2**	**T_3**	**T_4**	**LSD**
Total Protein (g/L)	74.00^{a}	74.00^{a}	68.00^{b}	68.00^{b}	5.72
Albumin (g/L)	48.33^{a}	42.00^{ab}	39.00^{ab}	34.00^{b}	12.25
Globulin (g/L)	25.67	32.00	29.00	34.00	15.13
Glucose (mmol/L)	4.57^{a}	3.93^{ab}	3.70^{b}	3.67^{b}	0.74
Urea (mg/dL)	9.07^{ab}	8.73^{b}	9.67^{a}	8.77^{b}	0.65
Cholesterol (mmol/L)	1.87^{ab}	1.17^{b}	1.80^{ab}	2.60^{a}	1.12

a, b = Means in the same row having different superscripts differ significantly ($P< 0.05$), T_1 = 0% forage, T_2 = 5% *Ficus sycomorus* leaf meal, T_3= 5% *Parkia biglobosa* leaf meal, T_4 = 2.5% *Ficus sycomorus* + 2.5% *Parkia biglobosa* leaf meals ,LSD=Least Significant Difference.

Conclusion

The study showed that *Ficus sycomorus* leaf meal in the diets of weaner rabbits at 5% level provided a positive effect on the parameters evaluated. It is therefore recommended that *Ficus sycomorus* leaf meal could be safely incorporated into the diets of weaner rabbits at 5% inclusion level to meet their protein requirements as an alternative to expensive conventional protein sources.

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Received: 12th July, 2018
Accepted: 21st December, 2018