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PERFORMANCE CHARACTERISTICS, BLOOD PROFILE AND LIVER HISTOLOGY OF NEW ZEALAND WHITE RABBITS ADMINISTERED AQUEOUS *Ficus asperifolia* LEAF EXTRACT

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ABSTRACT

Various pharmacological actions such as anti-ulcer, anti-diabetic lipid lowering and antifungal activities have been described for *Ficus asperifolia. It* has been widely used in albino rats but with limited use in rabbits. This study was, therefore, conducted to evaluate the effect of aqueous *Ficus asperifolia* leaf extract (FALE) on the growth performance, blood profile and liver of New Zealand white rabbits raised under tropical conditions. A total of 36 rabbits consisting of two groups of 18 bucks and 18 does were allotted to six treatment groups after weight equalization on the basis of sex and levels of FALE administration (0ml, 10ml and 20ml of aqueous FALE) in a 2x3 factorial arrangement, with each treatment consisting of 6 rabbits; each treatment was further subdivided into 3 replicates of 2 rabbits per replicate. Data on growth, haematology and serum biochemistry were collected and analysed using analysis of variance (ANOVA). Means, where significant, were separated using Duncan Multiple Range Test at ($P<0.05$). The livers were dissected and preserved in Bouin's fluid while routine haematoxylin and eosin method was used to stain them. Aqueous *Ficus asperifolia* leaf extract significantly ($P<0.05$) affected total weight gain, total feed intake and feed efficiency while sex effect showed that final weight and total feed intake were significantly reduced in bucks (2011.11g and 1170.11g, respectively) compared to the does (2258g and1474.61g, respectively). Effect of interaction between *Ficus asperifolia* leaf extract and sex significantly affected total weight gain, total feed intake and feed efficiency. Haematological parameters were not influenced by the main effect of aqueous *Ficus asperifolia* leaf extract and sex except for white blood cells (WBC) which were significantly higher ($7.90x10^9$/L) in bucks. Also, WBC and lymphocytes were significantly influenced by their interactive effect. Total protein, globulin, glucose, Alkaline phosphate and calcium were significantly affected by levels of aqueous *Ficus asperifolia* leaf extract while cholesterol and calcium were influenced significantly by sex. Haematoxylin and Eosin (H&E) stained sections of liver tissue of rabbit bucks showed no remarkable vascular changes. This study indicated that aqueous *Ficus asperifolia* leaf extract is anti-hyperglycemic and can support rabbit production without any negative influence on the immune status of rabbit.

Keywords: Growth performance, rabbits, *Ficus asperifolia*, liver histology

INTRODUCTION

The bulk of proteins consumed in most developing countries like Nigeria are of plant origin and these sources lack certain essential amino acids. Proteins of animal origin are more balanced and complete in amino acids (Aduku, 2004). The production of animals like rabbits, with very short gestation period and production cycles, can be a solution to the problem of protein shortage in Nigeria. Rabbits play an important role in the supply of animal protein to the Nigerian populace (Amaefule *et al*., 2005). They are efficient converters of feed to meat and can utilise up to 30% crude fibre as against 10% by most poultry species (Egbo *et al*., 2001). According to Spore (2007) and Soyebo (2006), rabbits have the potential to improve on the diet and income of many poor households. This is due to its high growth and fecundity rates as well as low investment and labour cost. Nutritionally, rabbits have higher protein (20-21%) and lower fat content (10-11%) when compared with meat from other species. Rabbit meat has a cholesterol value of 169mg/100g (dry matter basis) when compared with beef (200mg) and chicken (220mg); and low sodium content (Janieri, 2003).

Many valuable therapeutic plants have been brought into limelight in livestock feed and production research. Treatment of various diseases using medicinal plants has increased globally due to its therapeutic efficacy and safety (Hakim *et al*., 2007). Their availability and increased usage throughout the world has led many researchers to study their various biological activities. Mansi and Lahham (2008) reported that medicinal plants used to treat hypoglycemic or hyperglycemic conditions are of considerable interest for ethno-botanical communities. Ghasemi *et al.* (2012) also affirmed that 80% of the world's population use herbal medicine according to a World Health Organization report. *Ficus asperifolia* (Miq.), which is commonly known as sandpaper tree ("Eweipin" in Yoruba), is one of the many valuable therapeutic plants used in a wide range of plant preparations as wound-healing agents, antihelminthic and purgative (Sofowora, 1996.) as well as reverse cases of sterility and fertility (Ojo *et al*., 2016). It is also said to be effective in the treatment of piles, asthma, gonorrhea, hemoptysis and urinary diseases as a result of the phytochemicals. Phytochemical studies carried out on leaves of some Ficus species by Ojo and Akintayo (2014) showed the presence of alkaloids, saponins, tannins, cardiac glycosides, steroids, cardenolides and phlobtannins while terpenes, flavonoids, anthruinones and chalcones were not detected.

Previous work done by Omoniwa and Luka (2012) on the aqueous extract of *Ficus asperifolia* revealed that it exerted hypoglycemic and hypolipidemic effects on diabetic rats and the leaves have higher levels of protein, crude fibre and minerals than some Nigerian vegetables. This plant is used without the knowledge of its toxic potential. The liver is an organ that has an extensive range of functions including detoxification, plasma protein synthesis and generation of biochemicals.

Today, liver damage is one of the very common ailments in the world leading to series of severe health problems ranging from metabolic disorders to even death. One of the methods that contributes to the detection of some changes in health and physiological status which may not be apparent during physical examination but affects the fitness of an animal is haematological examination (Esonu *et al*., 2001; Bamishaiye *et al*., 2009). Examination of blood provides the oppor-

tunity to clinically investigate the presence of several metabolites and other constituents in the body. It plays a vital role in the assessment of physiological, nutritional and pathological status of an animal (Aderemi, 2004; Doyle and William, 2006). However, there is dearth of information on the response of rabbits to aqueous *Ficus asperifolia* leaf extract (FALE). Therefore, this study investigated the effect of *Ficus asperifolia* leaf extract on the growth performance, blood profile and histology of liver of New Zealand White rabbits.

MATERIALS AND METHODS

Experimental Site

The research work was carried out at the Rabbitry Unit of the Directorate of University Farms (DUFARMS) of Federal University of Agriculture, Abeokuta (FUNAAB), Ogun state, Nigeria. The region lies between latitude 7°10'N and longitude 3°2'E and an altitude of 830m above sea level. The experimental site is located in the derived savannah zone of southwestern Nigeria with an annual average rainfall of 1100 mm and peak temperature ranges from 28°C in December to 36°C in February with an average relative humidity of about 82% (Google Earth, 2019).

Experimental Animals and Management

36 New Zealand White rabbits (18 bucks and 18 does) with average weight of 2.1kg were purchased from reliable farms in Abeokuta. Before the arrival of the animals, the stable was thoroughly washed and disinfected in readiness for stocking. The animals were housed under the same conditions, fed concentrate (Table 1) and supplied water *ad-libitum*. This was supplemented with *Tridax procumbens* twice a week to prevent bloating. On the day of arrival, the animals, were given an antistress (Maxiyield®) with a duration of acclimatisation of two weeks.

Table 1: Nutrient composition of the commercial feed (as declared)

Ingredients	Composition
Crude Protein (%)	16.00
Fats/Oil (%)	5.00
Crude Fibre (%)	7.00
Calcium (%)	1.60
Available Phosphorus (%)	0.45
Lysine (%)	0.75
Methionine (%)	0.36
Salt (min) (%)	0.30
Energy (Kcal/kgME)	2450

Preparation of Test Ingredient

Fresh leaves of *Ficus asperifolia* were harvested within the environment of Federal University of Agriculture, Abeokuta. The leaves were sorted to remove contaminants, dead matter, sand particles and were air-dried for 10 days (away from sunlight) so as to retain its nutrients. The air-dried leaves were finely ground using an electric blender. The leaf meal obtained was then stored until it was ready for use. 200 g of the leaf meal was measured into conical flasks and extracted with 1000 ml distilled water for 24 hours. The mixture was filtered into 500 ml conical flasks with Whatman filter paper no. 1. The solution was filtered, decanted and filtered three times using a sieve to achieve the aqueous *Ficus asperifolia* leaf extract (FALE).

Experimental Design

This study was a 2 x 3 factorial layout in a completely randomised design. The factors were sex (buck and doe) and levels of FALE administration (0ml, 10ml and 20ml). 36 New Zealand White (NZW) mature rabbit bucks and does were divided into two groups of 18 bucks and 18 does. Each group was randomly assigned to six experimental treatment groups after weight equalization on the basis of sex and levels of FALE administration (0ml, 10ml and 20ml of aqueous FALE) in a 2x3 factorial arrangement, with each treatment consisting of 6 rabbits; each treatment was further subdivided into 3 replicates of 2 rabbits per replicate. They were administered the prepared aqueous (FALE) orally and daily for 3 weeks consecutively.

Data Collection

Performance Characteristics

Body weight gain: data on body weight were recorded by taking their pre-experimental body weight and subsequently on weekly basis. Body weight gain was calculated as follows:

Body weight gain (g) = Final body weight (g) – Initial weight gain (g)

Feed intake: this was obtained by subtracting the feed leftover of each animal from the quantity of feed given during the week. Feed intake was calculated as:

Total Feed intake (g) = Feed offered (g) – Feed left over (g)

Feed efficiency: This was calculated by dividing the total feed intake by total weight gain.

$$\text{Feed efficiency (FE)} = \frac{\text{Feed intake (g)}}{\text{Body weight gain (g)}}$$

Blood Collection

At the end of the 3rd week of *Ficus asperifolia* administration, blood was withdrawn from the ear veins of one rabbit per replicate of each treatment by means of 2.5ml sterile needle and syringe into labeled sample bottles containing ethylene diamine tetra acetate (EDTA) to prevent blood coagulation while another set of blood samples was collected into 2.5ml plain bottles (without anticoagulant) for blood serum analysis. The blood samples in EDTA bottles were used to determine haematological parameters {packed cell volume, haemoglobin concentration, white blood cells, red blood cells, heterophil, lymphocyte, eosinophil, basophil, monocyte, the mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC)} Blood samples in the plain bottles were tested for serum biochemical indices {total protein, albumin, globulin, glucose, cholesterol, alanine aminotransferase (ALT), aspartate transferase (AST), alkaline phosphatase (ALP), calcium, and phosphorus}.

Liver collection

At the end of the 3rd week, three rabbits were selected per treatment for liver

histology. The livers were removed from the rabbits after dissection and were preserved in sample bottles containing 10% formaldehyde, dehydrated in series of alcohol (70%, 90%, 100%), cleared in xylene, embedded in paraffin wax after which the tissues were sectioned (5 mm) and stained with H&E (haematoxylin and eosin).

Statistical Analyses

Data obtained were subjected to analysis of variance. Significant differences ($p<0.05$) between the means were separated using Duncan-Multiple Range Test as contained in SAS (2010), and the interactions were tested as shown in the statistical model:

$$\Upsilon_{ijk} = \mu + A_i + B_j + AB_{ij} + \sum_{ijk}$$

Where Υ_{ijk} = Expected output

μ = Population mean

A_i = Effect due to i^{th} sex (i = 1(bucks,2(does)

B_j = Effect due to j^{th} levels of FALE administration (j = 1(0ml),2(10ml),3 (20ml))

AB_{ij} = Interactive effect between i^{th} sex and j^{th} levels of FALE administration

$\sum_{ijk}$ = Experimental error.

RESULTS

Oral administration of aqueous *Ficus asperifolia* leaf extract (FALE) to rabbits at various doses significantly affected total weight gain, total feed intake and feed efficiency (Table 2). These performance parameters in rabbits in the treated groups (T2 (rabbits administered 10 ml aqueous FALE): -0.25g, 1184.33g and -0.03; T3 (rabbits administered 20 ml aqueous FALE): -27.25g, 1231.17g and -0.04, respectively) were observed to decrease more rapidly than in the control group (T1(rabbits administered 0 ml aqueous FALE): 152g, 1551.08g and 0.08, respectively). Sex effect showed that final weight and total feed intake were significantly reduced in bucks (2011.11g and 1170.11g respectively) compared to the does (2258g and1474.61g, respectively).

Final weight was not significantly ($P>0.05$) influenced by the interaction between the levels of *Ficus asperifolia* leaf extract and sex (Table 3). However, total weight gain, total feed intake and feed efficiency were significantly affected. The values of these parameters were highest in does (210g, 1755.67g and 0.106, respectively) in the control group followed by bucks (94g, 1346.50g and 0.055, respectively) also in control group while the least values were observed in those (both sexes) administered the extract (Table 3).

Table 2: Main effects of *Ficus asperifolia* leaf extract and sex on the performance parameters of New Zealand White rabbits

Parameters	Levels of administration of aqueous *Ficus asperifolia* leaves extract			Sex	
	0ml	10ml	20ml	Buck	Doe
Initial weight (g)	2041.67±66.35	2137.5±77.12	2100.00±89.21	2011.11±56.07	2175.00±56.52
Final weight (g)	2193.67±97.35	2137.25±88.33	2072.75±102.55	2011.11±72.15[b]	2258.00±56.35[a]
Total Weight gain (g)	152.00±41.82[a]	-0.25±29.36[b]	-27.25±38.53[b]	0.00±34.36	83.00±40.64
Total feed Intake (g)	1551.08±139.25[a]	1184.83±99.02[b]	1231.17±80.27[b]	1170.11±78.05[b]	1474.61±97.93[a]
Feed efficiency	0.08±0.02[a]	-0.03±0.04[b]	-0.04±0.04[b]	-0.02±0.03	0.03±0.03

[a,b] Means on the same row with different superscripts are significantly(P<0.05) different.

Table 3: Interactive effect of *Ficus asperifolia* leaf extract and sex on the performance parameters of New Zealand White rabbits

Sex	Buck			Doe		
Parameters/LoFALE	0ml	10ml	20ml	0ml	10ml	20ml
Initial weight (g)	2000.00±118.15	2058.33±108.33	1975.00±101.04	2083.33±79.50	2216.67±108.33	2225.00±118.15
Final weight (g)	2094.00±134.09	2019.33±134.68	1920.00±136.86	2293.33±139.55	2255.17±83.45	2225.50±102.54
Weight gain (g)	94.00±16.49[ab]	-39.01.53±46.58[b]	-55.00±70.95[b]	210.00±71.45[a]	38.50±25.29[b]	0.50±40.23[b]
Total feed Intake (g)	1346.50±151.26[ab]	1052.33±92.47[b]	1111.33±132.15[b]	1755.67±179.48[a]	1317.33±151.40[b]	1350.83±20.77[ab]
Feed efficiency	0.055±0.011[ab]	-0.045±0.055[ab]	-0.071±0.069 [b]	0.106±0.033[a]	-0.016±0.059[ab]	-0.002±0.037[ab]

[a,b] Means on the same row with different superscripts are significantly(P<0.05) different.

Haematological indices considered in this study were not significantly affected by FALE (Table 4). Mean Corpuscular Volume, Mean Corpuscular Haemoglobin, and Mean corpuscular Haemoglobin Concentration values (60fl, 20pg, and 33g/dl, respectively) were the same for all the treatments. Packed cell volume and lymphocytes recorded the highest mean values of 40.50% and 67.50%, respectively for rabbits administered 10ml of the extract. Only white blood cell was significantly influenced by sex as highest WBC ($7.90x10^9$/L) was recorded for the bucks (Table 4).

Table 4: Main effect of *Ficus asperifolia* leaves extract and sex on haematological parameters of NZW rabbits

Parameters	Levels of administration of aqueous *Ficus asperifolia* leaf extract			Sex	
	0ml	10ml	20ml	Buck	Doe
Packed cell volume (%)	38.83±1.08	40.50±1.45	40.33±0.88	38.89±0.84	40.89±0.93
Haemoglobin (g/dl)	12.57±0.67	13.88±0.86	14.05±0.58	13.44±0.78	13.56±0.36
RBC ($x10^{12}$/L)	6.27±0.34	6.95±0.43	7.03±0.30	6.72±0.39	6.78±0.18
WBC ($x10^9$/L)	7.02±0.73	6.72±0.75	7.50±0.71	$7.90±0.49^a$	$6.26±0.53^b$
Heterophil (%)	32.17±2.40	31.50±2.38	33.67±1.38	32.89±1.81	32.00±1.56
Lymphocytes (%)	66.67±2.22	67.50±2.50	64.17±1.42	65.33±1.77	66.89±1.64
Eosinophil (%	0.33±0.33	0.33±0.21	0.33±0.21	0.56±0.24	0.11±0.11
Basophil (%)	0.33±0.21	0.17±0.17	0.67±0.21	0.44±0.18	0.33±0.17
Monocytes (%)	0.50±0.22	0.50±0.34	1.17±0.40	0.78±0.32	0.67±0.24
Mean corpuscular volume (fl)	60.00±0.00	60.00±0.00	60.00±0.00	60.00±0.00	60.00±0.00
Mean corpuscular haemoglobin (pg)	20.00±0.00	20.00±0.00	20.00±0.00	20.00±0.00	20.00±0.00
Mean corpuscular Haemoglobin Concentration (g/dl)	33.00±0.00	33.00±0.00	33.00±0.00	33.00±0.00	33.00±0.00

White blood cells (WBC) and lymphocytes were significantly influenced by the interactive effects of levels of aqueous *Ficus asperifolia* leaf extract (FALE) and sex (Table 5). White blood cells (WBC) of bucks administered 0ml ($8.33x10^9$/L) and 10ml ($8.17x10^9$/L) were statistically similar but significantly higher than that of does administered 10ml FALE ($5.27x10^9$/L). Conversely, highest ($p<0.05$) lymphocytes were recorded for does administered 0ml (71.00%) while the least value of 62.33% was recorded for bucks also in the control group (Table 5).

Table 5: Interactive effect of *Ficus asperifolia* leaf extract and sex on haematological parameters of New Zealand White rabbits

Sex	Buck			Doe		
Parameters/LoFALE	**0ml**	**10ml**	**20ml**	**0ml**	**10ml**	**20ml**
Packed cell volume (%)	37.33±0.88	40.67±2.19	38.67±0.33	40.33±1.67	40.33±2.40	42.00±1.00
Haemoglobin (g/dl)	11.57±0.59	14.33±1.68	14.43±0.28	13.57±0.94	13.43±0.81	13.67±0.20
RBC ($x10^{12}$/L)	5.77±0.29	7.17±0.84	7.23±0.62	6.77±0.48	6.73±0.39	6.83±0.09
WBC ($x10^{9}$/L)	8.33±0.93^{a}	8.17±0.49^{a}	7.20±1.17^{ab}	5.70±0.21^{ab}	5.27±0.69^{b}	7.80±1.03^{ab}
Heterophil (%)	36.33±3.18	28.33±2.40	34.00±2.52	28.00±1.15	34.67±3.53	33.33±1.76
Lymphocytes (%)	62.33±2.19^{b}	70.33±2.60^{ab}	63.33±2.67^{ab}	71.00±1.00^{a}	64.67±4.06^{ab}	65.00±1.53^{ab}
Eosinophil (%	0.67±0.67	0.33±0.33	0.67±0.33	0.00	0.33±0.33	0.00
Basophil (%)	0.33±0.33	0.33±0.33	0.67±0.33	0.33±0.33	0.00	0.67±0.33
Monocytes (%)	0.33±0.33	0.67±0.67	1.33.±0.67	0.67±0.33	0.33±0.33	1.00±0.58
Mean corpuscular volume (fl)	60.00±0.00	60.00±0.00	60.00±0.00	60.00±0.00	60.00±0.00	60.00±0.00

^{a,b} Means on the same row with different superscripts are significantly($P<0.05$) different

Total protein, globulin, glucose, alkaline phosphate and calcium were significantly affected by levels of aqueous *Ficus asperifolia* leaf extract while cholesterol and calcium were influenced significantly by sex (Table 6). Total protein (5.60g/dl, 5.87g/dl and 6.65g/dl), globulin (2g/dl, 2.07g/dl and 3.42g/dl) and calcium (6.97mg/dl, 7.25mg/dl and 8.55mg/dl) values increased significantly with increasing inclusion levels of aqueous *Ficus asperifolia* leaf extract; rabbits administered 0ml and 10ml of the extract recorded the highest mean values for glucose (138 mg/dl) and alkaline phosphate (81.67u/l) respectively. Cholesterol level was significantly higher in the bucks (83.69 mg/dl) compared to the does (43.52mg/dl) while calcium was significantly higher in the does (8.49mg/dl) than in bucks (6.69 mg/dl). Does administered 20ml of *Ficus asperifolia* leaf extract recorded highest mean values for globulin (3.67g/dl), glucose (142.67mg/dl) and calcium (10.10mg/dl) while highest mean value of 83.33u/l was recorded in does administered 20ml of *Ficus asperifolia* leaf extract (Table 6).

Table 6: Main effect of *Ficus asperifolia* leaf extract and sex on serum biochemical indices of New Zealand White rabbits

Parameters	Levels of Administration of Aqueous *Ficus asperifolia* Leaves Extract			Sex	
	0ml	10ml	20ml	Buck	Doe
Total protein (g/l)	5.60±0.24^{b}	5.87±0.28^{ab}	6.65±0.23^{a}	5.96±0.24	6.12±0.26
Albumin (g/dl)	3.57±0.15	3.78±0.47	3.25±0.17	3.82±0.28	3.24±0.16
Globulin (g/dl)	2.00±0.30^{b}	2.07±0.46^{b}	3.42±0.28^{a}	2.12±0.37	2.87±0.31
Glucose (mg/dl)	138.00±3.99^{a}	101.33±10.70^{b}	122.50±10.76^{ab}	113.00±8.06	128.00±8.92
Cholesterol (mg/dl)	57.68±12.38	60.38±13.62	72.75±11.27	83.69±5.82^{a}	43.52±8.37^{b}
Aspartate amino transferase (u/l)	47.50±,57	50.67±2.65	47.83±2.30	49.33±2.11	48.00±1.45
Alanine amino transferase (u/l)	45.17±1.96	41.33±1.02	41.50±0.62	41.67±0.90	43.67±1.38
Alkaline phosphate (u/l)	71.33±1.33^{b}	81.67±2.85^{a}	72.83±2.30^{b}	74.33±2.11	76.22±2.61
Calcium (mg/dl)	6.97±0.13^{b}	7.25±0.43^{b}	8.55±0.76^{a}	6.69±0.18^{b}	8.49±0.45^{a}
Phosphorus(mg/dl)	7.97±1.69	8.77±1.18	6.58±1.03	8.32±1.17	7.22±0.99

^{a,b} Means on the same row with different superscripts are significantly($P<0.05$) different.

Globulin, glucose, cholesterol, aspartate amino transferase, alkaline phosphate and calcium were significantly ($p<0.05$) influenced by the interaction between levels of aqueous *Ficus asperifolia* leaf extract (FALE) and sex while other indices were not significantly affected (Table 7). Alkaline phosphate was significantly highest in NZW rabbit does administered 10ml of the extract and lowest in rabbit does administered 0ml.

Table 7: Interactive effect of *Ficus asperifolia* leaf extract and sex on serum biochemical indices of New Zealand White rabbits

Sex	Buck			Doe		
Parameters/ LoFALE	0ml	10ml	20ml	0ml	10ml	20ml
Total protein (g/l)	5.60±0.45	5.80±0.29	6.47±0.47	5.60±0.31	5.93±0.56	6.83±0.09
Albumin (g/dl)	3.87±0.15	4.27±0.83	3.33±0.09	3.27±0.07	3.30±0.42	3.17±0.35
Globulin (g/dl)	1.67±0.50^{b}	1.53±0.57^{b}	3.17±0.47^{ab}	2.33±0.29^{ab}	2.60±0.68^{ab}	3.67±0.32^{a}
Glucose (mg/dl)	135.67±2.73^{ab}	101.00±14.73^{b}	102.00±12.99^{b}	140.33±8.17^{ab}	101.67±18.84^{b}	142.67±1.86^{a}
Cholesterol (mg/dl)	84.17±6.38^{a}	86.30±13.85^{a}	80.60±12.87^{a}	31.20±4.88^{b}	34.47±7.98^{b}	64.90±20.18^{ab}
Aspartate amino transferase (u/l)	48.00±2.00^{ab}	55.00±4.04^{a}	45.00±2.65^{b}	47.00±2.89^{ab}	46.33±0.33^{ab}	50.67±3.38^{ab}
Alanine amino transferase (u/l)	43.67±1.45	41.00±2.08	40.33±0.33	46.67±3.84	41.67±0.88	42.67±0.67
Alkaline phosphate (u/l)	73.00±2.00^{ab}	80.00±4.04^{ab}	70.00±2.65^{b}	69.67±1.45^{b}	83.33±4.63^{a}	75.67±3.38^{ab}
Calcium (mg/dl)	6.73±0.09^{c}	6.33±0.12^{c}	7.00±0.55^{c}	7.20±0.15^{bc}	8.17±0.30^{b}	10.10±0.42^{a}
Phosphorus(mg/dl)	9.60±1.89	10.10±2.00	5.27±1.34	6.33±2.85	7.43±1.11	7.99±1.33

^{a,b,c} Means on the same row with different superscripts are significantly($P<0.05$) different.

The livers of rabbits in control group showed normal architecture of hepatic lobule with normal arrangement of hepatocytes but there was gradual disruption of hepatic lobules from those administered 10 ml aqueous FALE to the group administered 20 ml aqueous FALE and they appeared atrophied and shrunken as compared to control group (Figures 1-3). Focal periportal coagulative necrosis was observed in animals administered 10 ml and 20 ml aqueous FALE (Figures2 and 3). The necrotic areas showed cellular lysis with collapsed stroma, pyknotic nuclei and lymphocytic infiltration. It was absent in hepatocytes for animals of control group.

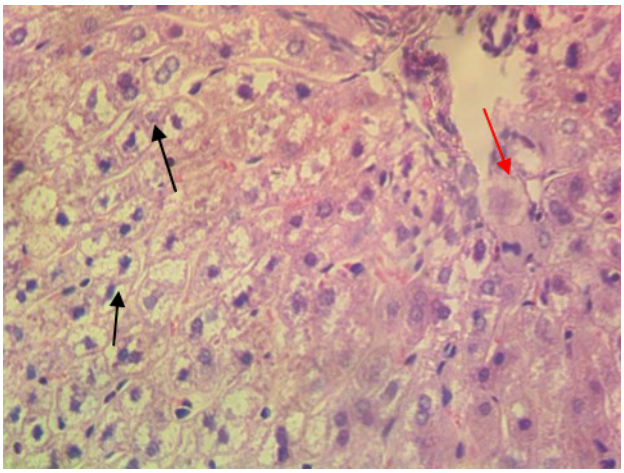

Fig. 1: Photomicrograph of liver of rabbit buck administered 0 ml of *Ficus asperifolia* leaf extract.

The hepatic cords are closely-packed. There is marked vacuolar degeneration (black arrows) of the hepatocytes with the periportal hepatocytes (red arrow) appearing spared. There is no remarkable vascular change.

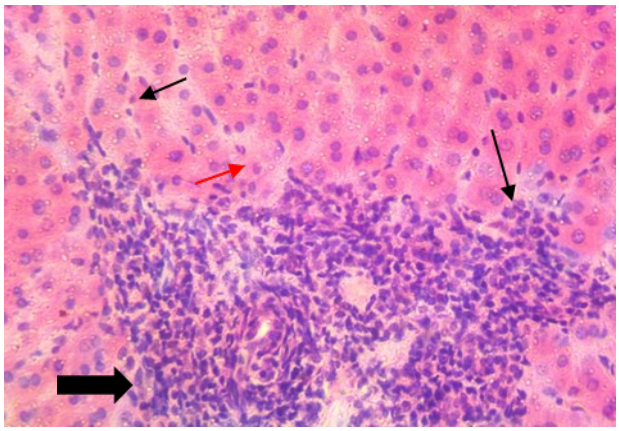

Fig. 2: Photomicrograph of liver of rabbit buck administered 10 ml of *Ficus asperifolia* leaf extract

Hepatic plates are closely packed. There are a few random foci of single-cell hepatocellular necrosis (black arrows). There are dense aggregates of mononuclear inflammatory cells (thick arrow). There is moderate Kupffer cell hyperplasia (red arrows). There is no remarkable vascular change.

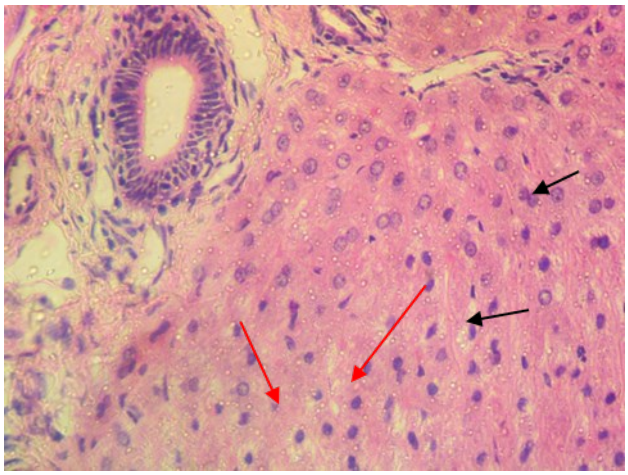

Fig. 3: Photomicrograph of liver of rabbit buck administered 20 ml of Ficus asperifolia leaf extract.

The hepatic plates are closely packed. There are multiple foci of necrotic hepatocytes with pyknotic, angulated nuclei (black arrows). There is no remarkable vascular change. There are a few foci of mild vacuolar change of hepatocytes (red arrows).

DISCUSSION

Aqueous extract of *Ficus asperifolia* leaf (FALE) exhibited significant anti-hyperglycemic activity which resulted in the significant weight loss observed in the treated rabbits as compared to those in the control group. This study suggests that sex may be an important factor for consideration when selecting animals to be used in ethnobotanical studies as does performed better than bucks. The differences in bodyweight of bucks and does in this study agreed with earlier submissions on sexual dimorphism in livestock species (Mahgoub *et al.*, 2005) and disagreed with the investigations of some other researchers (Lukefahr and Ozimba, 1991; Ozimba and Lukefahr, 1991) who reported that unlike in most domestic livestock species, sex does not strongly influence growth in rabbits.

Higher total feed intake recorded in the does in this study is similar to the result obtained by Lazzaroni *et al.* (2012). They reported a slight effect of gender on productive performance, with females showing higher feed intake than males. Lazzaroni and Biagini (2002) also obtained higher feed intake by female Carmagnola Grey rabbits than males.
The non-significant values recorded for haematological parameters of rabbits administered queous *Ficus asperifolia* leaf extract in this study are an indication that the experimental animals were not affected by the different levels of administration of *Ficus asperi-*

folia leaf extract and were within the normal ranges (RAR, 2009) reported for healthy rabbit. This non-significant difference could be an indication of the wellness of the animals throughout the experimental period as normal haematological parameters of an animal are direct indication of absence of disease (Olafadehan *et al*., 2010). Packed cell volume is an indication of total red blood cell in whole blood compared to proportion of plasma and buffy coat/white blood cell portion. It gives certain indication of the health status of the animal. In this study, administration of *Ficus asperifolia* leaf extract at 10% inclusion level gave the highest packed cell volume although not significantly different from others. This result is an indication that *Ficus asperifolia* leaf extract has substance(s) which promotes erythrocyte production although it is contrary to the report of Dangarembizi *et al.* (2013), who reported reduced packed cell volume in rats administered aqueous *Ficus thonningii* leaf extract. Sandberg (2002) stated that reduced PCV could result from reduced bioavailability of dietary iron due to the action of anti-nutritional factors such as tannins, phytate and other polyphenolic phytochemicals. The numerical increase observed in the values of haemoglobin, red blood cell and monocytes with increasing aqueous *Ficus asperifolia* leaf extract could be attributed to inclusion at different doses to the rabbits. This could have led to a more efficient erythropoiesis in the rabbit bucks administered the extract by increasing the bone marrow capacity to produce red blood cells thereby increasing and improving the blood level condition hence, preventing anaemia (Togun *et al*., 2007; Chineke *et al*., 2006; Etim, 2010 and Etim *et al*., 2014). It is also an indication that rabbits given aqueous *Ficus asperifolia* leaf extract had the ability to transport higher volume of oxygen in their system which may enhance their health status. White blood cells play a prominent role in disease resistance especially with respect to the production of antibodies and the process of phygocytosis (Soetan *et al*., 2013). The significant increase observed in white blood cell mean values obtained from the rabbit bucks in this study was still within the reported physiological range of 4.50-11.00 x109/L for normal rabbits (RAR, 2009). This result implies that the animals' ability to combat infection or illness was not negatively affected since white blood cells are known to be among the body's defence mechanisms that fight against non-self or pathogenic organisms. Elevated values of white blood cell differentials are indicators of stress, tissue damage, chronic inflammation and presence of both parasitic and non-parasitic infection in the system of animals (Douglas *et al*., 2010; Martinez-Silvestre *et al*., 2013; Pendl, 2013; Wolfensohn and Lloyd, 2013). This may explain longevity as reported by Mbanasor *et al.* (2003) and Etim (2010) for haematological parameters of rabbit does fed *Aspilia africana* leaves. This also agrees with the report by Reilly (1993) and Etim (2010) that normal range of values for WBC indicated that the animals were healthy; resulting in high degree of resistance to disease (Soetan *et al*., 2013, Etim, *et al*., 2014) and enhanced adaptability to local environment and disease -prevalent conditions (Kabir *et al*., 2011, Okunlola *et al*., 2012, Iwuji and Herbert 2012, Isaac *et al*., 2013 and Etim *et al*.,2014). It is also consistent with the observation of Bello and Tsado (2013) that WBC values within the normal range is an indication that there were no microbial infections or presence of foreign bodies or parasites in the circulatory system of the experimental animals. Ologbobo *et al.* (1986) observed that an increase in WBC count above normal is an indication of the presence of exogenous sub-

stances and foreign bodies in the body. In this study, there was no case of such abnormal rise in values of WBC. Lymphocytes are important in forming barriers against local disease conditions and may be involved in antibody formation (Frandson, 1981). The available results also agree with the report of Ameen *et al.* (2007) that when the values for lymphocytes, leucocytes and neutrophils fall within the normal ranges as observed in this study, it implies that the feeding pattern, in this case the experimental extract, did not affect the immune system.

The analysis of the serum biochemical characteristics of the rabbits recorded significant increase in total protein and globulin values of the rabbits administered aqueous extracts of *Ficus asperifolia*. Serum biochemical analysis is used to determine the level of liver damage and to evaluate protein quality and amino acid requirements in animals (Harper *et al*., 1979). Significant increase observed in the serum protein albumin and globulin of rabbits administered aqueous *Ficus asperifolia* leaf extract might be because the rabbits were able to utilise the available protein in the extract better, leading to non-compromise of the immune system of the animals since globulins are serum proteins involved in the immune system (Charles, 2001). Also, the significant increase observed in the results of the alkaline phosphatase (ALP) among the groups administered 10ml aqueous *Ficus asperifolia* leaf extract could be attributed to a number of factors including the homeostatic mechanisms of the animals and the active ingredients in the aqueous extracts of *Ficus asperifolia* leaves being functionally relative to each other in respect of quantities available (Noboru, 2001). Alkaline phosphatase is present in tissues throughout the entire body of the animal but is particularly concentrated in the liver, bile duct, kidneys, bones and the placenta (Kim and Wycoff, 1991).

Serum biochemical parameters are useful markers for the evaluation of health status of animals. It also shows alterations in organs and tissues of animals fed with unconventional feed sources (Kudair and Al-Hussary, 2010). The results obtained show that at the doses used, *Ficus asperifolia* extract did not seem to cause any parenchymal cell lesions, necrosis or drug induced-hepatitis. It was notable that ALP levels were significantly elevated in all of the rabbit does that received *Ficus asperifolia* leaf extract. Alkaline phosphatase (ALP) is also associated with osteoblastic activity and hence its levels are elevated in rapidly growing animals (Alhassan *et al*., 2009). Serum albumin, total bilirubin and total protein concentrations were also used as clinical tools in assessing the hepatosynthetic function. The concentrations of these biochemical markers of liver function in the blood were unaltered by administration of *Ficus asperifolia* extract at the doses used; confirming that *Ficus asperifolia* was not hepatotoxic in the short term. This result is in line with the previous work done by Omoniwa *et al*., (2013) which reported *Ficus asperifolia* phytochemical screening to have detected flavonoids, saponins, alkanoids, tannins, steroids and many others which increase the level of calcium and alkaline phosphatase in the experimented animals.

According to Harper *et al.* (1979), in serum enzymology, tissue-soluble enzymes are a very important adjunct to clinical diagnosis of tissue damage or disease. Both transaminases in conjunction with other enzymes are used as indicators of liver and heart damage. Aspartate aminotransferase (AST) is in-

volved in the inter-conversion of aspartate to glutamate while alanine transferase is involved in cellular metabolism and energy processes of the cell via the citric acid cycle. The detailed histological study of liver revealed atrophy of hepatocytes in focal areas. The treated animals showed mild focal coagulative type of necrosis in hepatocytes. The probable mechanism may be the inhibition of mitochondrial function by dual effect on both beta-oxidation energy productions by inhibiting the synthesis of nicotinamide, flavin adenine dinucleotide and depletion in glutathione that result in decreased ATP production and development of cell necrosis (Drabo and Khatry, 2012).

CONCLUSION

This study indicated that aqueous *Ficus asperifolia* leaves extract is anti-hyperglycemic and support rabbit production without any negative influence on the immune status of the rabbit.

RECOMMENDATION

This study suggests that sex may be an important factor for consideration when selecting animals to be used in ethnobotanical studies as does performed better than bucks.

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