P ERFORMANCE AND SERUM BIOCHEMISTRY OF GROWER RABBITS FED WITH SOME BROWSE SPECIES SUPPLEMENTED WITH A CONCENTRATE DIET

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ABSTRACT
Sixteen (16) growing male rabbits with an average initial weight of 925g were used for a 42 day feeding trial to evaluate their performance and serum biochemical profile They were randomly allotted into four (4) treatments of four (4)Rabbits each. Animals in all the treatment groups were fed a concentrate diet at 50g/rabbit/day followed by Browse (T1 Bamboo, T2 Senna, T3 Gmelina and T4 Teak at 100g/rabbit/day, one hour later, on cut and carry basis. All the animals were served water ad libitum. Completely randomized experimental design was used. Data were analyzed using a one way analysis of variance. Significant treatments means were separated using least significant difference (L.S.D) contained in SPSS version 16 (2016). Samples of the browse plants and the concentrate diet were analysed for their proximate composition using the standard procedure of AOAC (2000) Water intake values were significantly (($p>0.05$) *different and increased with increase in dry matter intake. T1 (180ml) had the highest water intake, while T3 (150ml) had the lowest. Values for daily weight gain (7.90 – 12.20g), feed conversion ratio,(7.68 – 8.78) and daily feed intake (68.77g – 93.90g) were all significantly different, with T1(Bamboo) having the best values, , concentrate intake values were however not significantly different. All the serum biochemical indices evaluated were all within normal range of values for growing Rabbits, all the values were not significantly different except alkaline phosphate (7.10 – 10.50 Iu/L). It was concluded that the concentrate and the browse species had adequate array of nutrients, bamboo was the most palatable of the browse plants evaluated, followed by Teak, Senna was the least. palatable, all the browse plants did not have adverse effects on the biood biochemical constituents of the Rabbits evaluated .All the browse plants evaluated were recommended for Rabbit feeding.*

Key words: Serum , Water Intake, Grower Rabbits, Browse Species, Supplement Diet,

INTRODUCTION

Rabbit production is suitable because their feeding do not compete with man for feed ingredients and have some advantages over other animals i.e. short gestation period, high fecundity rate, low cost of investment and small body size which makes if affordable for poor Nigerians (Ocheja *et a*l 2014) Rabbit production is not restricted by any taboo or particular beliefs that prevents the eating of Rabbit meat, it is a source of low cost, high quality protein that uses only local forages and food wastes that are of no direct use for humans. (Fielding 1991) Increased production of Rabbits also requires improved nutrition in the face of dwindling and high cost of feed materials

There is urgent need therefore to search for supplements that are readily available cheap, nutritionally adequate and at the same time not in direct use by humans. Given the scarcity and low nutritive value of forage during the long dry season, it is expedient to search for browse species that tend to retain their leaves during the long dry season, four browse species that hold promise in the dry season feeding of rabbits are Bamboo *(Oxytenanthera abbyssinica), Teak (Tectona grandis), Senna, (Senna siamea) and Gmelina (Gmelina arborea*.

According to Norton (1994) the nutritive value of a feed is measured by its ability to deliver nutrients to an animal for maintenance and growth in absence of toxic factors, it is a function of feed digestibility and voluntary feed intake. Blood bio chemical constituents reflects the physiological response of animals to its internal and external environments, which include feeds and feeding,(Esonu *et a*l 2001) Blood biochemistry studies are usually done to establish the diagnostic baseline of blood characteristics for routine management practice of farm animals (Daramola *et al* 2015).

Olabanji *et a*l, (2007) cautioned that when using non conventional feeds, it is important to assess the health status of the animals because some are known to affect blood parameters. They further reported that a readily available and fast means of assessing the clinical and nutritional health status of the animals in feeding trial may be the use of blood analysis. Endogenous substances might manifest through reduced protein utilization thereby, increasing the catabolism of amino acids which would be subsequently degraded into urea and creatinine (Sathyamorthy *et al*, 2005).

Schalm *et a*l (1975) posited that accurate determination of creatinine clearance is crucial to rational drug therapy because many drugs are either partially or totally eliminated by the kidney.

The aim of this work therefore was to evaluate the performance and serum biochemistry of growing Rabbits fed some browse plants supplemented with a concentrate diet

MATERIALS AND METHODS

The study was carried out at the Rabbit Production unit of the Teaching and Research farm of the Department of Animal Production Kogi State University, Anyigba (Latitude 70 6'N and Longitude $60^0$43'E). The area is characterized by about 6-7 months of rainfall ranging from 1400-1500mm annually. The ambient temperature ranges from 25^0C to 35^0C with the highest in March and April (Kowal and Knabe, 1972). The housing facilities were houses with concrete floor, 2 windows, and 1 door. The Animals were kept separately in hutches made of wood and net. The hutches had one door each so as to allow easy feeding and easy record taking.

The house/room was properly cleaned, washed and disinfected before moving the hutches inside. The feeders and drinkers were equally washed and disinfected as well. The experimental feed materials were:

(A) Bambaranut waste
(B) Rice offal
(C) Bamboo leaves (*Oxytenanthera abyssinica)*
(D) Gmelina Leaves (*Gmelina arborea)*
(E) Teak Leave (*Tectona grandis*)
(F) Senna Leaves *(Senna siamea)*
(G) Table Salt

The rice offal was purchased from Ankpa while the bambaranut offal was purchased from Anyigba market. The bambaranut offal and rice offal were sun-dried and mixed together to compound the experimental diet. The browse species were harvested from Kogi State University Campus, Anyigba, where they grew naturally.

TABLE 1: COMPOSITION OF EXPERIMENTAL CONCENTRATE DIET

INGREDIENTS	COMPOSITION (%)
BAMBARANUT OFFAL	75.60
RICE OFFAL	24.20
TABLE SALT	0.20
TOTAL	100

Sixteen (16) male grower rabbits of mixed breeds and with initial body weight ranging from 920g to 940g were used for the study. The animals were randomly assigned to four treatments of Four (4) rabbits each. The animals were conditioned to stability by feeding them adequately for 1 week (7 days) with the concentrate and the browse plants used for each treatment. The study lasted for 42 days after an adjustment period of 7 days.

All the animals were fed 50 grams per head per day of the supplement and 100 grams per Rabbit per day of the browse (T1 Bamboo Leaves, T2 Senna Leaves, T3 Teak Leaves and T4 Gmelina leaves) clean drinking water of known quantity was given to the rabbits ad *libitum.*

The concentrates were given in the morning (9am) followed by the browse plants 2 hours later on cut and carry basis.

Feed dry matter intakes were calculated from differences between absolute feed served and the left over the following day before feeding.

The initial weight of the rabbits was determined at the beginning of the experiment. This was done using a weighing scale (spring balance). Daily water intake was measured by using a beaker to supply a known volume of water every morning, taking into account water loss due to evaporation. Loss due to evaporation was measured by putting a known volume of water in a drinker (same as those used by the rabbits) in the morning within the rabbit house along the passage. The difference in volume of water observed the next morning was used to estimate the volume of water evaporation. This volume was deducted from the left over water to determine the daily water intake.

The dry matter content of the samples were determined by drying to constant weight for 24 hours in an oven. at 105C. Crude protein was determined by Kjeldahl procedure, ether extract, Crude fibre, Ash content determination were according to standard procedure (AOAC, 2000). The Nitrogen Free Extract (NFE) was calculated by subtracting the sum of percentages of crude fibre, ether extract, crude protein and ash from 100..

Blood Sample Collection

The blood sample for serum biochemical determination were collected in sample bottles from the jugular vein of each rabbit, using needles and syringes. The sample bottles contained ethylene diamine tetra acetic acid (EDTA) anticoagulant, the blood samples were centrifuged thus allowing the clear sample to be separated for testing. The Serum was analyzed for creatume, urea, alkaline phosphate cholesterol and blood sugar according to Baker and Siverton (1985).

The experimental design was a completely randomized design (CRD). The data were analyzed by a one way analysis of variance (ANOVA) and treatment means were separated, where significant differences existed using statistical package identified as Statistical Package for Social Science (SPSS) 16th version. (2006)

RESULTS AND DISCUSSION

PROXIMATE CHEMICAL ANALYSIS

The proximate chemical composition of feed ingredients, concentrate and the browse Speciess are presented in Table 2

Table 2: Proximate Composition of Dietary Iingredients, Concentrate and Browse Species(Dry Matter %)

Proximate composition	ambaranut waste	Rice offal	Concentrate	Bamboo leaves	Senna leaves	Gmelina leaves	Teak leaves
Dry matter	94.61	92.60	88.91	53.57	34.15	25.97	39.45
Crude protein	19.71	6.011	6.30	10.69	15.25	11.80	10.13
Crude fibre%	13.96	40.1	19.41	18.75	16.67	14.02	10.97
Esther extra%	5.20	5.31	5.22	1.45	2.71	2.35	2.10
Ash %	5.23	20.4	7.33	10.14	5.26	7.56	9.17
Nitrogen free Extract%	54.32	26.3	51.66	59.27	60.11	63.69	68.13

The dry matter content of 94.61% for bambaranut waste was higher than 88.60% reported by Ocheja,*et al* (2009). The dry matter content of 92.60% for rice offal was almost the same as that obtained by Olomu, (1995).

The crude protein content of 19.71% for bambara nut waste was slightly higher than 17% reported by Onyimonyi and Onukwufor (2003).

The crude fibre of 16.96% obtained for bambara nut waste was in line with 16.89% reported by Ocheja et al (2009) the 40% crude fibre was at par with 40.1% reported by Olomu (1995). The crude protein and Nitrogen free extract of the concentrate were within the range recommended for grower rabbits in the tropics ARC (1980).The Ash content of 5.23% and 5.20% Ether extract were within the range reported by Onyimonyi and Ene (2003).

The differences observed in the proximate composition of these by products were in line with the views of Oyediji, (2001) who reported that the protein, fibre and energy of these by-products differ within themselves according to source and variety and that each producer have their different methods of extracting the primary product which may affect their composition.

The crude protein content of 15.25% obtained for *Senna* was slightly higher than 14% reported by Allismith and Matthew (2009).

The dry matter of 53.57% and 59.27% Nitrogen free extract obtained was slightly higher than 45% dry matter and 42.8% nitrogen free extract reported by Asaolu *et al* (2011) for bamboo leaves, while 14.5% crude protein, 2.25% Ether extract and 23.3% crude fibre were slightly higher than 10.69% crude protein, 1.45 Ether extract and 18.45% crude fibre obtained by Asaolu, *et al.,* (2011).

The Nitrogen free extract of 63.69% obtained was higher than 56% reported by Okagbare *et al* (2004) for Gmelina leaves. 14.02% crude fibre obtained was equally lower than 18.6% crude fibre recorded by Okagbare *et al* (2004). These differences may be due to varieties of leaves, soil composition as well as differences in the season in which experiments were conducted.

Performance Characteristics of The Experimental Rabbits

The daily water intake showed significant ($p>0.05$) difference across the treatments with T1 (180ml) having the highest and T3 (150ml) having the lowest. Umoru (2007), reported a daily water intake range of 162.70 – 195.62ml, this higher range could be due to differences in the forages and concentrates fed. The water intake followed similar trend with the dry matter intake. This was in line with the report of Okagbare (2004) that water consumption in growing rabbits increased as the level of feed intake increased. this was also supported by Taiwo *et.al.*,(2005) who reported that more water is required as feed intake increases .The daily feed intake (68.77 – 93.90g), daily weight gain(7.90 – 12-20g), and feed conversion ratio(7.68 – 8.78) were all significantly ($P<0.05$) different , with T1 having the best values. The daily feed intake values were lower than 101.46 – 112.88g reported by Adel *et al (2018),*who Fed Moringa leaf meal to Rabbits , but higher than 63.23g – 88.36g recorded by Ocheja *et al* (2011) for Rabbits fed browse and a concentrate diet. These descripancies could be attributed to differences in the browse and concentrates fed . The final body weight range of 1262g (T2) – 1426g (T1) were lower than 1715g – 1839.33g obtained by Fawzia *et al (*2019) who fed rabbits with pricly pear and its by-products , but at par with with 1261.33g – 1425.33g reported by Ocheja *et al* (2011)

Table 3: Performance Characteristics of The Experimental Rabbits

	T1	T2	T3	T4	SEM
Dialy weight gram (g)	1426.00a	1255.00	1262.00	1352.00	23.06
Concentrate intake (g)	12.20[a]	7.90[c]	7.91[c]	9.85[b]	0.63
Browse intake (g)	43.90[a]	18.77[c]	19.50[c]	36.30[b]	3.16
Total daily feed intake(g)	93.96[a]	68.77[b]	69.50[b]	86.30[a]	3.20
Daily water intake (ml)	180.00[a]	155.00[c]	150.00[c]	172.50[b]	4.12
Feed conversion ratio	7.68[a]	8.71[b]	8.78[b]	8.76[b]	0.36

a,b,c Means on the same row with different super scripts differ significantly (p>0.05)
SEM: Standard Error of Means

Serum Biochemical Profile of Experimental Rabbits

The serum biochemical profile of the experimental Rabbits are presented in Table 4. The values for urea, creatinine, cholesterol and blood sugar were not significantly (P.>0.05) different , all the values were however within normal ranges reported by Mitruka and Rawnsley (1977) . The urea values of 17.90 – 20.10 Mmol 1^{-} were higher than 14.73 – 17.93 Mmol 1 reported by Etim and Oguieke (2011) for rabbits fed *Aspillia africana*, but lower than 30.96 – 35.40(mg/,dl) reported by Jiwuba *et al* (2016) for weaner Rabbits fed varying levels of dried Gmelina arborea leaf-meal. The low blood urea level was an indication of adequate protein Utilization , highprotein quality of the diets fed and also the fact that there was no tissue catabolism. The normal range of creatinine (0.95 - 1.10 mg/dl) of the Rabbits , also indicated that that the Rabbits were not diabetic. The low-normal cholesterol(21.60 – 23.10) level showed that the rabbits did not suffer from anorexia, diabetes, liver dysfunction, and malabsorption of fat which are symptoms of abnormal cholesterol level in the blood . the alkaline phosphate level of 7.10 – 10.50 (Iu/l) were significantly (P<0.05) different but were within the normal range reported by Mitruka and Rawnsley (1977) ,the values were lower than 11.05 – 18.52(Iu/L) reported by Gbore and Akele (2010) for Rabbits fed dietary fumonsin , these abnormally high alkaline phosphate values suggests liver damage. higher creatinine values suggests muscular wastage.

Abnormally high alkaline phosphate is indicative of bone disease, liver disease, bile obstruction. Variation could also be due to feed, collection and handling of blood samples, genetic, environment sex and age of animals.

Table 4: Serum Biochemical Profile of Experimental Rabbits

Parameters	Treatments				SEM
	T_1	T_2	T_3	T_4	
Blood Sugar (mg/dl)	28.70	26.95	27.90	28.60	1.05
Creatinine (mg/dl)	0.95	1.05	0.98	1.10	0.88
Urea (Mmol $^{-}$l)	18.50	17.90	18.70	20.10	2.86
Alkaline phosphate (IU/L)	7.10[b]	7.20[b]	10.50[a]	10.30[a]	1.40
Cholestool (mg/dl)	22.50	23.10	21.60	22.15	2.90

ab, Treatment means on the same row with different superscripts differ significantly (p<0.05)
SEM Standard Error of Means

CONCLUSION AND RECOMMENDATIONS

CONCLUSION

, T1(Bamboo) recorded the highest feed intake and best growth performance parameters, the water intake was influenced by the dry matter intake of the rabbits. Senna (T_2) had the best array of nutrients , but the least palatable The concentrate was very palatable and had a good array of nutrients adequate for growing Rabbits in the tropics, .All the serum biochemical indices determined , did not show significant difference except Alkaline phosphate whose values were significantly different, all the serum biochemical values were within normal range for growing Rabbits

RECOMMENDATIONS

The four browse plants used in this study as well as the concentrate may be recommended as feeds for Rabbits, especially during the long dry season. Further research using higher levels of these browse leaves as well as different classes of Rabbit is suggested.

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