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Heamatological and Serum Biochemical Indices of Red Sokoto Goats Fed Different Forms of Neem Leaves and a Concentrate Diet

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Abstract **Original Research Article**

The study evaluated the heamatological and serum biochemical indices of red sokoto goats fed different forms of neem (Azadirachta indica) leaves and a concentrate diet. The experiment was carried out at the small ruminants unit Teaching and Research Farm, Federal University of Kashere. Gombe state , Nigeria. Sixteen red sokoto goats (bucks) were allotted into four (4) treatments of four goats each. The goats were fed fresh neem leaves, neem leaves hay, neem leaves meal and neem leaves silage at 300g/goat/day for treatments 1, 2, 3 and 4 respectively; and concentrate diet at 125g/goat/day for a duration of sixty three (63) days. Water was served ad-libitum. The experimental design was a completely randomized design; data were analyzed using a one way analysis of variance. The significant means were separated using least significant difference contained in SAS 2010 statistical package. The concentrate and the neem leaves were analyzed for their proximate composition using the method of AOAC 2000. Values for all the haematological indices except esinophil were not significantly different, the values for esinophil ranged from 1.07–1.57%. All the serum biochemical values were significantly ($P<0.05$) different, the values for urea ranged from 7.37 – 10.23mmol/l. It was concluded that the various forms of the neem leaves and the concentrate diet were safe for the goats. Further research using other breeds and other species of ruminants was recommended.

Keywords: Heamatological, Serum Biochemical, FeedIntake, Red Sokoto Goats, Neem Leaves.

1. INTRODUCTION

Neem leaves as supplement to basal diets of crop residues have been shown to improve feed utilisation and animal performance in ruminants (Raghuvansi *et al.,* 2017). Neem leaves are high in crude protein. There are, however, wide variations in the reported values. Crude protein concentrations between 17.5% and 18.7% have been reported (Bhowmik *et al.,* 2010). Neem leaves are reported to be deficient in copper, manganese (Niranjan *et al.,* 2008), zinc and phosphorus (Rao *et al.,* 2011). Levels of minerals, especially trace minerals, are expected to vary widely due to differences in the mineral content of the soil in which the trees grow.

Nutrition, breed, sex, age, reproductive status, environmental factors, stress etc are known to affect blood biochemical parameters (Balikci *et al.,* 2007). Belewu and Ogunsola (2011) asserted that serum creatinine helps in evaluating the liver functions and diseases while serum urea evaluates renal function and it may also indicate dehydration. as well as feed protein quality and utilization. Endogenous substances could manifest through reduced protein utilization thereby increasing the catabolism of amino acids which would be subsequently degraded into urea and creatinine (Sathyamorthy *et al.,* 1981). Accurate determination of creatinine clearance time is crucial to rational drug therapy because many drugs are either partially or wholly elimininated by the kidney (Schalm, 1975).

The main problem confronting ruminant livestock producers in Nigeria today is the seasonal fluctuation in the availability of forages for ruminant. The use of leaves from trees that retain their leaves during the long dry season, to feed ruminants during the difficult period is very important .one of such leaves that can be used is leave from Neem (*Azadirachta indica)* tree

This use of neem leaves would also require safety tests such as blood analysis.

The aims of the present study therefore were:

1. To determine the heamatoogical profile of red sokoto goats fed neem leaves and a concentrate diet.
2. To determine the serum biochemical profile of red sokoto goats fed neem leaves supplemented with a concentrate diet.

2.0 MATERIALS AND METHODS

2.1 Experimental site

The study was conducted at the Teaching and Research Farm, Faculty of Agriculture, Federal University of Kashere in Gombe State, Nigeria. The state is situated within latitude $9^{o}54'46N$ and longitude $9^{o}46^{o}'27E$ and $10^{o}57^{o}$ E and altitude of 349m above sea level. The annual rainfall of Kashere ranges between 800mm-900mm per annum and is characterized by distinct dry season (October-May) and rainy season (June-September) seasons. The annual mean temperature ranges from $30\text{-}32^{0}$ C and it experiences a relative humidity of 17-90% (National Geospatial Intelligence Agency, 2012).

2.2 Experimental Animals, Management, Feed preparation and Experimental procedure

Sixteen (16) red sokoto goats aged between 7-9 months were sourced from within Kashere and its environs and randomly allocated into four (4) Treatments of four (4) goats each. The animals were treated with Ivomec for endo and ecto parasites control at 0.3ml each and oxytetracycline, hydrochloride and procaine penicillin at 2.0ml each to take care of scouring and nasal discharge and to provide a common health status. The Neem (*Azadirachta indica)* leaves used for this experiment were collected from within the Federal University of Kashere Campus. The consisted of Bambara nut offal (BNO), Beans offal meal (BOM), Cassava peel meal (CPM), Yam peel meal (YPM), Maize offal (MO), Full fat soya bean (FFSB), Egg shell meal (ESM), Wood ash (Ash). These components were thoroughly mixed after pounding and grinding as the case may be.

Each treatment had (4) goats, each goat was fed 125g of the concentrate per day, and the Neem leaves at 300g per Goat per day of which the Neem leaves was fed first, then the concentrate one hour later, the Goats were served water *Ad-libitum.*

Treatment one (T_1) was fresh neem leaves; treatment two (T_2) was neem leaves hay; treatment three (T_3) was neem leaf meal and Treatment four (T_4) was neem leaves silage.

2.3 The concentrate offered the goats were weighed daily and the left over was also weighed and subtracted from the quantity of feed that was served to determine the feed intake of the animal. The experiment lasted for sixty three (63) days.

2.4 Blood Sample Collection

The blood samples for heamatological and serological studies were collected in sample bottles from the jugular vein of each goat using needles and syringes. The blood samples for serological analysis were put in sample bottles containing 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 creatinine, urea, alkaline phosphate, cholesterol and blood sugar using the method of Baker and Silverton (1985). The uncoagulated blood samples were analysed for packed cell volume, heamoglobin concentration, red blood cell count and white blood cell count.

Table 1: Composition of Experimental Diet

Feed ingredients	**Value (%)**
Bambara nut offal	15.00
Beans offal meal	1.50
Cassava offal meal	4.50
Sweet potato peel meal	3.00
Maize offal	56.00
Yam peel meal	10.25
Full fat soya bean meal	5.00
Egg shell meal	1.00
Wood Ash	0.75
Table salt	2.00
Total	100.00
Calculated nutrient content:	
Crude protein	16.15
Crude fibre	11.30
Metabolizable energy (Kcal/kg diet)	2,700

2.5 Chemical Analysis

Samples of the Neem leaves and the concentrate diet were analyzed for their proximate composition using the method outlined by AOAC (2000).

Crude Protein: The usual method employed in determination of protein in feed stuff was Kjeldahl method of nitrogen determination. The known quantity of sample was digested with sulphuric acid (H_2SO_4 and NaSO4 in the ratio of 1:20). The digested sample was then distilled after neutralizing excess of acid with alkali (40% NaOH), and thus the released ammonia was trapped either in N/10 (in macro) or in 2% boric acid solution. The distillate was collected in standard acid (N/10 H2SO4 or standard N/10 HCl) and titrated against standard alkali (N/10 NaOH), but when the distillate was collected in 2% boric acid (micro method) this was titrated against standard acid (N/100 H2SO4 or and crude protein was calculated by multiplying factor 6.25).

Crude fibre: Crude fibre in feeding stuffs was estimated through digestion of dry and fat free amount of feed sample by boiling it in a weak solution of acids for 30minutes followed by boiling in weak solution of alkali for 30minutes and then deducting the ash from the residue obtained.

Ether extract: Ether extract was estimated by extracting the amount of feed sample through fat solvents like petroleum ether for a period of 5-6 hours at 55-60^{0}c in specially made soxlet apparatus.

Moisture: The moisture content of feed sample was determined by heating it to constant weight at 100^{0}c under atmospheric pressure the water content of feed removed as vapour.

Ash: The feed contains both organic and inorganic matter in it. The sample was heated at 550^{0}c for 5 hours. The organic matter got oxidized as CO_2. The remaining material left was the inorganic matter.

Nitrogen Free Extract (NFE): Contains soluble carbohydrate, hemicellulose, part of lignin and acid insoluble ash. Value of NFE was derived by deducting the total value of crude protein, crude fat, crude fibre, moisture and ash from 100.

2.6 Experimental Design and Statistical Analysis

The experimental Design was Completely Randomized Design (CRD). Data obtained was analyzed using a one-way Analysis of variance (ANOVA), means with significant differences were separated using Least Significant Differences (LSD) with the aids of Statistical Package identified as Statistical Package for Social Science (SPSS) version 23, 2015 edition.

3.0 RESULTS AND DISCUSSION

3.1 Proximate Composition of Neem (*Azadirachta indica*) Leaves and Concentrate Diet

The proximate composition of neem leaves and concentrate diet is summarized in Table 2. The protein content of 6.44-9.19% for the neem leaves were lower than the values of 12-18% recommended for growing ruminants in the tropics (NRC 1996). However, the supplement is expected to take care of this deficiency while the protein content of the concentrate diet (16.80%) was within the values of 12.18% recommended by NRC (1996). The crude fibre content of 9.5% for the supplement diet and 18.00% to 23.80% for the neem leaves were adequate for the goats (Lakpini *et al*., 2002). The ether extract values of 3.60% for the Neem leaves were within recommended values for ruminants while that of the concentrate diet was at par with the upper limits values of 5-6% which if exceeded may impede appetite and fibre digestion (Maithison *et al*., 1997).

Table 2: Proximate Composition of Experimental Diets

Nutrient	Treatments				
	T_1	T_2	T_3	T_4	Conc
Crude protein	9.19	8.55	6.44	7.88	16.80
Crude fiber	18.50	19.30	18.00	23.80	9.50
Ash	11.50	11.80	8.00	14.50	3.15
Ether extract	3.60	3.70	3.00	4.80	5.85
Moisture	34.00	15.00	40.50	10.00	5.05
Dry matter	64.00	85.00	59.50	90.00	94.95
NFE	23.20	41.65	22.76	41.02	60.65

Conc.=Concentrate, NFE=Nitrogen Free Extract

3.2 Heamatological Profile of Experimental Goats

The heamatological profile of the experimental goats is summarized in Table 3. All the heamatological parameters determined were not significantly (P<0.05) different, except values for the esinophils (1.07 – 1.57 %) which showed significant (P>0.05) difference All the reported values were within normal range for goats, this indicated that the supplement diets were nutritionally adequate for the goats (Ocheja *et al.*, 2021). Abnormally low packed cell volume , red blood cell count and heamoglobin concentration signifies aneamia while abnormally high white blood cell count

is indicative of microbial or parasitic infections (Olabanji *et al*., 2007) The rams were however free from all of the above conditions.

Table 3: Heamatological Profile of Experimental Goats

Heamatological Parameters	Treatments				SEM
	T_1	T_2	T_3	T_4	
Packed Cell Volume (%)	19.07	1 9.40	19.47	18.60	1.91
Heamoglobin(g/dl)	5.70	6.13	6.13	6.20	0.64
Red Blood Count($x10^3$ ul)	1.67	1.90	1.57	1.67	0.09
White Blood Count($x10^3$ ul)	78.33	66.00	77.67	77.33	20.46
Esinophils (%)	1.37^{ab}	1.57^{a}	1.37^{ab}	1.07^{b}	0.48
Lymphocytes	60.63	60.90	60.57	60.90	1.42
Mean Corpuscular Heamoglobin	33.37	32.90	33.17	33.50	0.84
Mean Corpuscular Volume	62.80	58.33	69.40	55.63	5.35

a, b, Treatment means on the same row with different superscripts differ significantly ($p<0.05$)
SEM= Standard Error of the Means:

Serum Biochemical Profile of Experimental Goats

The serum biochemical profile of the experimental goats is presented in Table 4. Values for all the serum biochemical indices determined showed significant ($P<0.05$) differences, the values for creatinine ranged from 2.30 – 3.57 mol/l and that of urea was 7.37 – 10.23 mmol/l. All the values however fell within normal range for goats, this result ranks with that obtained by Oyibo *et al.,* 2020 for West African dwarf goats fed fed some browse plants ans a concentrate diet.

Abnormally high alkaline phosphate is indicative of bone disease, liver disease, bile obstruction (Ocheja *et al*., 2021; Oyibo *et al.,* 2020) the values showed that the goats were free from these conditions Variations could also be due to feed preparation and handling of blood samples, genetic, environment, sex and age of animals (Shettima *et al.,* 2021: Belewu and Ogunsola 2010). Normal urea values indicates that the protein was of good quality and was well utilized (Okpanachi *et al.,* 2018).

Table 4: Serum Biochemical Profile of Experimental Goats

Parameters	Treatments				SEM
	T_1	T_2	T_3	T_4	
Tqtal Protein (mg/dl)	37.90a	28.80c	39.10a	35.53b	1.23
Creatinine (mol/l)	3.57a	2.30c	2.67bc	2.83b	0.15
Urea (mmol/l)	10.23a	7.37d	8.60c	9.43b	0.33
Alkaline phosphate m/l	28.23d	34.30c	41.63a	38.50b	1.51
Cholesterol (mg/dl)	107.73a	54.47d	93.60b	86.03c	5.88

a, b,c,d Treatment means on the same row with different superscripts differ significantly ($p<0.05$)
SEM Standard Error of Means

4.0 CONCLUSION AND RECOMMENDATIONS

4.1 Conclusion

Nearly all the heamatological values showed no significant differences among the treatment means, while values for the serum biochemical indices were all significantly different. The different forms of the neem leaves and the concentrate diet were safe for feeding the goats

4.2 Recommendations

Supplement diets containing varying levels of bambara nut offals and rice offal can be fed to weaner Yankasa rams for improved heamatological and serum biochemical profiles. Further research should be carried out using other breeds of goats as well as other species of ruminants such as sheep and cattle.

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