



NUTRIENT DIGESTIBILITY AND HAEMATOLOGY OF YANKASA SHEEP FED DIFFERENT LEVELS OF AFRICAN BIRCH (*Anogeissus leiocarpus*) LEAVES AND WHEAT OFFALS

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ABSTRACT

The study was conducted to investigate nutrient digestibility and haemato-biochemical indices of twenty (20) growing *Yankasa* sheep fed varying levels of African birch (*Anogeissus leiocarpus*) and wheat offals. Four diets (16% CP) were formulated using varying levels of African birch (*Anogeissus leiocarpus*) leaves at 0, 10, 20 and 30% in the diets and termed as diets 1, 2, 3 and 4 respectively. Each treatment diet was randomly allotted with five randomly selected animals each and laid in a Completely Randomized Design. The experiments lasted for 12 weeks and the 11th week, the nutrient digestibility and blood haematology were determined. For nutrient digestibility, the total feed intake and the faeces voided obtained and percentage of their relationship was determined. For haematology and biochemical studies, 5 ml of blood samples were collected via jugular vein of randomly sampled rams, stored and transported in refrigerated condition to laboratory for analysis. DMD of diet 1 (86.69%) was statistically ($P<0.05$) superior to diets 2, 3 and 4 (85.11, 82.05% and 79.4%). All the haematological and biochemical values obtained for all parameters across the treatments were statistically ($P<0.05$) similar and fell within the normal range values for healthy rams. Based on these findings, diet 1 could be recommended to be fed to *Yankasa* sheep for optimum utilization.

Keywords: Ruminants, Nutrient, Nitrogen, Blood, Faeces

INTRODUCTION

Small ruminants rearing in Nigeria, like in any other developing world, are important in supporting the livelihoods of poor resource farmers in terms of income generation and assets (Shittu, *et al.*, 2008). However, production of small ruminants is limited among other factors by inadequacy of year-round feed availability (Fasae, *et al.*, 2012).

In the Savannah zone of Nigeria, the basic diets of most ruminants in the dry season is based on crop residues, dry standing grasses and rangeland forages, which decline in both quality and quantity, resulting in low productivity of animals (FAO, 2004) for human consumptions (Bourn, *et al.*, 1994). Attempts were made to augment animal feed deficits, which have become an increasingly critical component of the integrated food chain (FAO, 2004) of human and livestock need, thus, resulting in high cost and scarcity (Gebregiorgis *et al.*, 2011), particularly, the conventional feedstuff (Ndamitso *et al.*, 2011).

Therefore, an alternative cheap source of feed that will improve the scope of animal production as well increase the amount of protein intake by Nigerians needed to be over-come (Ukorebi *et al.*, 2019; Tijjani *et al.*, 2023) is paramount. A good number of diverse plant portions especially leave; seeds and tree fruits in Nigeria have been used as feed ingredients by researchers as an alternative to conventional feed material to addressed the challenges in livestock sector (Egbeyale *et al.*, 2013; Tijjani *et al.*, 2023).

African birch leaves could be used either as supplement or as based diet when availability of other herbaceous forages is limiting for the production potential of goats and possibility other ruminants (Yahaya, *et al.*, 2000). This research was, therefore, designed to study nutrient digestibility and



haemato-biochemical indices of growing *Yankasa* rams fed graded levels of African birch (*Anogeissus leiocarpus*) leaves and wheat offals.

MATERIALS AND METHODS

Study Area

The study was conducted at Abubakar Tafawa Balewa University (ATBU) Teaching and Research farm Bauchi, Nigeria. Bauchi is strategically located between latitude 9.3⁰ and 12.3⁰ north of the equator. Longitudinally the state lies between longitudes 8.5⁰ and 11⁰ east of the Greenwich meridian and its vegetation zone is Sudan Savannah. Bauchi state has a rainfall regime ranging from 1,300 mm per annum, which starts in the month of April and ends in the month of October (BASGD, 2006).

Experimental Animals

About a month to the arrival of animals, experimental pens were cleaned, disinfected with Rambo (Pimethrin 0.60%) and labelled. Twenty (20) growing *Yankasa* rams approximately 12-20 months old were used for the experiment. On arrival the animals were weighed and tagged for identification. The animals were quarantined for two weeks, during which they were treated with a broad-spectrum anthelmintic (Albendazole) against tape worms, vaccinated against *Petes des Petiis Ruminantes* (PPR) and external parasites (Ivomestin) administered subcutaneously. During the quarantine period, feed and water were provided *ad libitum*. The animals were randomly divided into four groups of five animals each and kept in individual pens of 2.5 M X 2.0 M space in a completely randomized design (Steel and Torrie, 1980).

Experimental Diets and Animals Feeding

Four diets (16% Crude protein) were formulated using varying levels of African birch (*Anogeissus leiocarpus*) and wheat offals, such that the two ingredients collectively contributed 30% of the diets, other ingredients are cotton seed cake, maize offal, cowpea shell, bone meal and salt. The animals were allowed 14-day period of adaptation to confinement and feeds. During the experiment, feeding was done every morning at about 07:00 hours and evening 15:00 hours for 84 days. Animals were provided good clean drinking water *ad libitum*. The feed and water intake of each animal were determined. The animals were weighed at the beginning of the experiment and weekly thereafter. Ingredients and chemical composition of the experimental diet are shown in Table 1.

Table 1: Ingredients Composition (%) of Experimental Diets

Ingredients (%)	T 1	T2	T ₃	T ₄
<i>Anogeissus leiocarpus</i>	0.00	10.00	20.00	30.00
Wheat offal	30.00	20.00	10.00	0.00
Maize offal	50.00	50.00	50.00	50.00
Cotton seed cake	12.50	12.50	12.50	12.50
Cowpea shell	5.00	5.00	5.00	5.00
Bone meal	2.00	2.00	2.00	2.00
Salt	0.50	0.50	0.50	0.50
Total	100.00	100.00	100.00	100.00

Digestibility Study

Digestibility study was conducted at the end of the experiment. Three animals per treatment (a total of 12) were used for the study. Each animal was transferred into metabolism cage equipped for separate collection of faeces. The animals were kept on their respective treatment diets and allowed a 7-day adjustment period to the cages before the faecal collection. The faecal sample collected for seven days. The quantity of feed offered, feed residue and faeces from each animal were determined. Faeces voided daily polythene each weighed and oven-dried at 60 – 65⁰c for 24 hours. The oven-dried faeces of each particular animal for 7 days were filled together and mixed thoroughly, and a fraction (10%) was taken for chemical and nitrogen analyses. The digestibility was determined using mathematical relationship, as thus:



$$\% \text{ Digestibility} = \frac{\text{Total nutrient intake} - \text{Total nutrient excreted}}{\text{Total nutrient intake}} \times 100$$

Haemato-Biochemical Studies

Haematological and biochemical studies were conducted using three rams from each treatment (a total of 12 rams). Five (5) ml of blood was collected from each animal through jugular vein following proper restraint during the 11th week of the experiment. The blood was collected in elastic tube containing Ethylene Di-amine Tetra Acetate (EDTA) and other samples in tubes without the anticoagulant. The blood samples were kept in freeze condition container and transported to the laboratory for analysis. Packed Cell Volume (PCV) was determined through micro-centrifugation and haemoglobin was measured through colorimetric technique of potassium cyanide (Schalm *et al.*, 1975). Blood samples without anticoagulant were centrifuged in 2,500 rpm for 15 minutes. Serum was withdrawn and stored at - 20^o c for biochemical analysis, which were performed by spectro-photometric methods. The examined profile included total protein, glucose and urea.

Chemical Analysis

The dry matter (DM) content of experiment diets was determined by drying the sample in oven at 60^oC for 48 hours the fibre fractions, Acid Detergent Fibre (ADF) and Neutral Detergent Fibre (NDF) were determined according to the method described by Goering and van Soest (1970). Hemicelluloses content were obtained by difference between NDF and ADF values (Church and Pond, 1982).

Statistical Analysis

Data obtained from the experiment were subjected to Analysis of Variance (ANOVA) in a Complete Randomized Designed statistical package of social sciences SPSS version 21 (2012) Where there was significant difference between treatments the means were separated using Duncan Multiple Range Test (DMRT, 1952).

RESULTS AND DISCUSSIONS

Chemical Composition of the Experimental Supplements

Table 2 showed the chemical composition of experimental diet. Dry matter content ranged from 86.19 to 89.35%. Organic matter content ranged from 74.09 to 76.33%. Crude protein content ranged from 15.97 to 16.41%. Ash content ranged from 9.86 to 15.26%. Neutral detergent fibre ranged from 39.52 to 45.77%. Acid detergent fibre content ranged from 30.68 to 36.52%. Hemicellulose content ranged from 8.84 to 9.96%.

Nutrient Digestibility

Table 3 showed the nutrient digestibility of *Yankasa* rams fed graded levels of *Anogeissus leiocarpus* leaves and wheat offals in the diets. Nutrients digestibility values obtained in this study were all above 65%, which indicates a good digestibility co-efficient for all diets had a good feeding value (69.20 to 95.60%) as reported by Garba *et al.* (2013).

Table 2: Chemical Composition of Experimental Diets

Parameters (%)	T1	T2	T3	T4
Dry matter	89.35	87.42	86.52	86.19
Organic matter	74.09	75.21	75.22	76.33
Crude protein	16.41	16.12	16.08	15.97
Ash	15.26	12.21	11.30	9.86
Neutral Detergent Fibre	39.52	42.65	44.22	45.77
Acid Detergent Fibre	30.68	32.69	34.73	36.52
Hemicellulose	8.84	9.96	9.49	9.25

Table 3: Nutrient Digestibility of *Yankasa* Rams Fed Graded Levels of *Anogeissus leiocarpus* Leaves and Wheat Wffals in the Diets.

Parameters	Treatments				SEM
	T1	T2	T3	T4	
DMD	86.69 ^a	85.11 ^b	82.05 ^b	79.74 ^c	1.09*
OMD	83.59 ^a	81.44 ^b	77.52 ^b	74.96 ^c	0.57*
CPD	88.70	88.96	88.83	89.70	1.35
NDFD	81.46 ^a	80.25 ^a	76.26 ^b	72.98 ^c	1.42*
ADFD	80.95 ^a	78.84 ^b	74.79 ^b	71.57 ^c	1.50*

^{a,b,c} Means within each row with different superscripts are significantly different* ($P < 0.05$), T1-0% *A. leiocarpus*, T2- 10% *A. leiocarpus*, T3-20% *A. leiocarpus*, T4-30% *A. leiocarpus*, SEM= standard error mean, DMD-dry matter digestibility, OMI- organic matter digestibility, CPD- crude protein digestibility NDFD- nutrient detergent fibre digestibility, ADFD-acid detergent fibre digestibility.

Dry Matter Digestibility (DMD)

The dry matter digestibility reported in this study were significantly ($P < 0.05$) different across the treatments. Animals fed diet 1 recorded the highest DMD value (86.69%), followed by diets 2 and 3 (85.11 and 82.05%) respectively, and then diet 4. (79.74%). The DMD values ranged from 79.74% to 86.69% was higher than 49.50% obtained by Abubakar *et al.* (2015). The result of this study is also higher than 56.22% obtained by Jokthan *et al.* (2012).

Organic Matter Digestibility (OMD)

Organic matter digestibility (OMD) was significantly higher ($P < 0.05$) in animals fed diet 1 (83.59%) while those fed diets 2 and 3 are similar (81.44 and 77.24%) statistically, diet 4 had lowest value (74.96%). The OMD values (74.96 to 83.59%) recorded in this study were much higher than the 51.07% reported by Hebbie (1989) for Sheep fed sorghum agro-industrial waste with molasses and cotton seed cake.

Crude Protein Digestibility (CPD)

Crude protein digestibility was similar ($P > 0.05$) across the treatment. The values ranged from 88.70 to 89.70% and were higher than the 60.15 to 63.18% obtained by Ashiru *et al.* (2017) for *Yankasa* sheep fed complete rations containing levels of ensiled sugarcane waste with poultry litter. The CPD in the current study is however below the 90.06 to 94.35%) reported by Garba *et al.* (2013) for growing *Yankasa* rams fed graded levels of *Tamarindus indica* leaves.

Neutral Detergent Fibre Digestibility (NDFD)

The NDFD was significantly different ($P < 0.05$) across treatments. Animals fed diets 1 and 2 had the highest values (81.46 and 80.25%) respectively followed by those fed diets 3 (76.26%) and then 4 (72.98%). The NDFD values range obtained in the current study (72.98 to 81.46%) were higher than 71 and 38.14% reported by Hirut *et al.* (2011) and Aime *et al.* (1999) respectively. Jokthan *et al.* (2012) also reported a lower NDFD of 17.22%.

Acid Detergent Fibre Digestibility (ADFD)

Acid Detergent Fibre Digestibility was significantly dissimilar ($P < 0.05$) across treatments. Animals fed diet 1 recorded the highest ADFD value (80.95%) followed by those fed diets 2 and 3 (78.84 and 74.79%) respectively and then 4 (71.57%). The ADFD values range recorded in this study (71.57 to 80.95%) was within the range of 72.62% reported by Hirut *et al.* (2011) for highland sheep fed a basal diet and urea treated maize stover.

Haematological Indices.

Table 3 Shows the haematological and biochemical indices of *Yankasa* rams fed graded levels of *Anogeissus leiocarpus* leaves and wheat offals diets.

Haemoglobin (Hb)

The haemoglobin (Hb) was the same ($P > 0.05$) and the range of values (9.50 g/dl to 9.80 g/dl) obtained in the current study were within the normal range of 9.00 g/dl to 15.00 g/dl for sheep as reported by Merck (1998) and also in agreement with the values reported for West African Dwarf goats and

sheep by Daramola *et al.* (2005) (7.00 to 15.00 g/dl) and Akinyemi *et al.* (2010) (8.15 to 10.75 g/dl) respectively.

Table 3: Haematological indices of *Yankasa* rams fed graded levels of *Anogeissus leiocarpus* leaves and wheat offals diets.

Haematological indices	Treatments					SEM	Normal range
	T1	T2	T3	T4	SEM		
Haemoglobin (g/dl)	9.73	9.66	9.50	9.8	0.21	NS	7.00-15.00a
Packed cell volume (%)	28.63	28.46	28.06	28.52	0.78	NS	25.00-30.00b
White blood cell (x10 ⁹ /L)	3.73	6.26	3.90	3.60	0.53	NS	3.20-15.00c
Red blood cell (x10 ⁹ /L)	7.62	7.74	8.03	7.99	0.34	NS	4.00-9.00d

T1-0% *A. leiocarpus*, T2- 10% *A. leiocarpus*, T3-20% *A. leiocarpus*, T4-30% *A. leiocarpus*, SEM= standard error mean, source; Merck (1998), Jawasreh *et al.*, (2010), Daramola *et al.*, (2005). a – Akinyemi, b – Opera, c – Scott, d – Tambuwal, NS- Non significant,

White Blood Cell (WBC)

The result of White Blood Cell (WBC) count recorded statistically similar ($P>0.05$). The WBC value range (3.73 to 6.26 x10⁹/L) were within the normal range (5 to 11 g/dl) reported by Scott *et al.* (2006) for sheep. The values obtained in the study were an indication that no presence of foreign bodies or parasites in the circulatory system of the experimental animals.

Red Blood Cell (RBC).

The Red Blood Cell (RBC) values recorded were similar statistically ($P>0.05$) and the value ranged from 7.62 to 8.03 x 10/L, which fell below the range of 9.3 to 13.5x10/L reported by Tambuwal *et al.* (2002). The RBC count in the current study is within normal range (4.00 to 9.00x10/L) as opined by Tambuwal

Biochemical Indices

Table 4 showed Biochemical indices of *Yankasa* rams fed graded levels of *Anogeissus leiocarpus* leaves and wheat offals in the diets.

Total Protein (TP)

Total protein values did not differ statistically ($P>0.05$). TP values at 0 hours before feeding (6.20 to 7.63 g/day) and 5 hours after feeding (6.33 to 7.33 g/d) respectively were within the range of 6.3 to 8.5 g/dl and 5.0 to 12.3 g/dl reported by Jawasreh *et al.* (2010) and Daramola *et al.* (2005) for Afee-Awassi sheep and West African Dwarf goats respectively.

Total Glucose (TG)

Total glucose values recorded were non-significant at 95% degree of probability. The TG values range (2.53 to 2.90 mmol) for 0 hours before feeding and 5 hours after feeding (3.07 to 57 mmol) in this study fell within the range of 2.50 to 3.90 g/dl reported by Davies *et al.* (2007), for sheep.

Table 4: Biochemical Indices of *Yankasa* Rams Fed Graded Levels of *Anogeissus leiocarpus* Leaves and Wheat Offals Diets

Biochemical indices		Treatments				SEM	Normal range
		T1	T2	T3	T4		
Total Protein (g/L)	0 hrs (before feeding)	7.63	6.86	6.20	6.20	0.32	5.00-12.30e
	5 hrs (after feeding)	7.33	7.03	6.33	6.66	0.28	
Total Glucose (mmol/L)	0 hrs (before feeding)	2.73	2.73	2.90	2.53	0.20	2.50-3.90f
	5 hrs (after feeding)	3.17	3.30	3.57	3.07	0.18	
Urea (mmol/L)	0 hrs (before feeding)	3.06	4.46	5.56	4.83	0.42	0.80-9.20e
	5 hrs (after feeding)	3.83	5.00	4.73	6.30	0.43	

T1-0% *A. leiocarpus*, T2- 10% *A. leiocarpus*, T3-20% *A. leiocarpus*, T4-30% *A. leiocarpus*, SEM= standard error mean, source; Merck (1998), Jawasreh *et al.*, (2010), Daramola *et al.*, (2005)., e – Daramola. NS- Non significant, *=normal range



Blood Urea

The blood urea values recorded were indifferent ($P>0.05$). The blood urea values range (3.06 to 5.56 mmol/L) at 0 hours before feeding and 5 hours after feeding (3.83 to 6.30 mmol/L) in the current study fall within the normal range (0.8 to 9.2 mmol/L) reported by Daramola *et al.* (2005) for West African Dwarf goats.

CONCLUSION AND RECOMMENDATION

Since diet 1 (0% *A. leiocarpus* and 30% wheat offal) had the highest percentage in DMD, OMD, NDFD and ADFD, while diet 4 (30% *A. leiocarpus* and 0% wheat offal) had the lowest, it was, therefore, concluded that diet 1 was a better feed in terms of digestibility. On the other hand, since all blood parameters recorded for all diets were similar and fall within the normal range for healthy animals, inclusion of up to 30% (*Anogeissus leiocarpus* and wheat offals) in the formulated diets had no adverse effects on performance of the animals.

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