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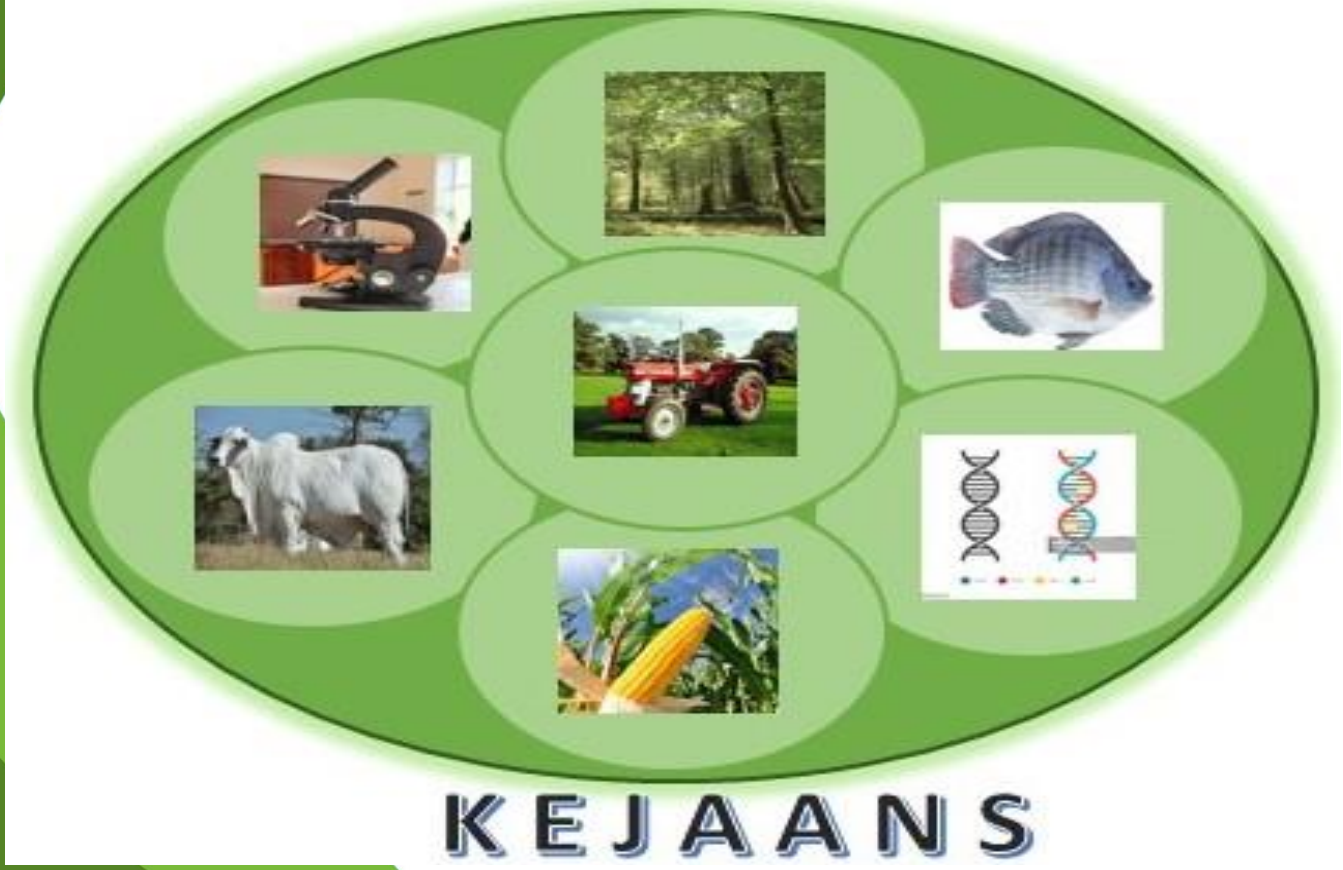

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HAEMATOLOGICAL RESPONSE AND RUMEN METABOLITES OF GROWING YANKASA RAMS FED UREA TREATED AND ENSILED MILLET STOVER BASED DIETS WITH SUPPLEMENTS

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ABSTRACT

A 90 days feeding trial was conducted to evaluate the effects of feeding ensiled urea treated millet stover based diets with supplementation on haematological profiles and volatile fatty acids using 30 growing Yankasa rams of mean initial weights of between 16.5-18.21kg. The rams were allotted to six treatments consisting five animals per treatment, with each unit taken as a replicate in a Completely Randomized Design. Four (4) kg urea was dissolved in 100 litres of water and sprinkled on 100 kg of crushed millet stover and then ensiled for 21 days was used as basal diet. A concentrate diet consisting of 300 g of cottonseed cake (diet 1), *Faidherbia albida* meal, (diet 2), cottonseed cake and maize offal (diet 3), *F. albida* and maize offal (diet 4), CSC and wheat offal (diet 5) and *F. albida* and wheat offal (diet 6) were all fed to each ram at 150g twice daily. Blood samples were collected and analysed for haematological profiles. Fifty (50 mls) of rumen liquor was withdrawn from 3 Yankasa rams of each diet to determine pH and short chain fatty acids. Significant differences ($p<0.05$) were observed on haemoglobin (8.07-10.40g/dl) before feeding and (6.80-10.80g/dl) 4hrs after feeding, packed cell volume (13.83-18.80%) before feeding and (14.10-22.60%) 4hrs after feeding, mean corpuscular haemoglobin (16.79-20.12pg) before feeding and (11.89-18.85pg) 4hrs after feeding and white blood cells (4.70-6.90×10^9/L) before feeding and (3.10-6.90×10^9/L) 4hrs after feeding. On the other hand, values of pH in the rumen liquor ranged from 5.40-9.10 before feeding, 6.20-9.30 three hours after feeding and 5.20-8.40 five hours after feeding. While for total short chain fatty acids ranged from 33.00-44.03 before feeding, 33.13-50.00 three hours after feeding and 35.43-49.30 after feeding respectively. Rams fed with *Faidherbia albida* and maize offal at 50:50 percent has better pH 5.20 to 9.10 before and after feeding, total volatile fatty acids 36.60 to 50.00 before and after feeding, as well as better haematological indices like haemoglobin concentration 5.05 to 5.73 all before and after feeding the diets, as such could be recommended for use as supplement diet in growing Yankasa rams

Key words: *Faidherbia albida,* haematological indices, millet stover, short chain fatty acids and urea

Introduction

Livestock sector, is an important part of in the agricultural production system which plays an essential role in the economy (Hassan *et al.*, 2010). However, livestock productivity in the tropics has suffered major setback due to inadequate quantity and quality of feeds for animals especially during dry season (Peters,

1998). According to Akinola *et al.* (2015) cereal crop residues are given less attention as important livestock feeds where over 40% is used fuel while only about 27.28% is used as animal feed. As such, ruminant animal in the arid and the semi-arid areas of the Sudan savanna survive almost entirely on drought tolerant pasture species and supplement their nutrient requirements generally from the available fodder trees and shrubs (Buterworth, 2002). Animals that depend on natural vegetation for their nutrition suffer heavy losses during the dry season which coincides with productive performance (Deavile *et al.*, 1994), as feed is a major problem for the livestock sector in West African developing countries causing animal nutritional diseases, reducing ruminant production (Nouroudine *et al.*, 2024)in that when the rain ceases the quantity and quality of grazing falls rapidly so that the dry season forage is highly fibrous and low in crude protein around 2% (Owen and Aboud, 1998). Leguminous trees and other fodder plants maintain higher protein and mineral contents during growth than grasses, which do not and decline rapidly in quality as they advance to maturity (Aganga and Tshwenyane, 2003). Unconventional feeds help to improve animal production at lower cost. Millet stover, sorghum stover and other crop residues are rich in cellulose and provide nutrients for the growth of rumen microbes (Bakel and Dardabou, 2019). Idrissou *et al.* (2017) found that Djallonke sheep supplemented with *Leucana leucocephala* and *Gliricidia sepium* respectively had significantly higher average daily gains. Furthermore, Yusuf (2021) found that Yankasa fed urea treated millet stover supplemented with *Faidherbia albida* pod meal and maize offal had significantly higher average daily gain, better feed conversion ratio and economically more feasible.

The objectives of the research were to determine the haematological response, short chain fatty acids and rumen liquor pH of growing Yankasa rams fed urea treated and ensiled millet stover based diets with supplements.

Materials and Methods

Study Area

The experiments were conducted at the Teaching and Research Farm, Small Ruminant Unit of the Federal University Dutsinma, Katsina State. The Departmental Livestock Teaching and Research Farm, according to Muhammad *et al.* (2018) reported 6.46 hectares (64,616M^2), on Latitude: 12^{o}25’39.3” N, Longitude: 7^{o}27’63.6” E and Altitude: 505m, using GPS

Preparation of experimental diets

Two experimental diets were prepared for the study: basal and supplemental diets.

The basal diet was prepared by dissolving 4kg of urea grade fertilizer in 100 litres of water to make a 4% urea solution, then sprinkled on 100kg of crushed millet stover and ensiled for 21 days. This served as the basal diet of the experiment. The basal diet was fed to the rams, *ad libitum*

Six supplemental diets were formulated using cotton seed cake, *Faidherbia albida* meal, maize offal and wheat offal. The supplements were formulated in such a way that each diet contained one or a combination of either of the two protein and energy sources cottonseed cake,or *Faidherbia albida* & maize offal or wheat offal). The supplements contained cottonseed cake, *Faidherbia albida*, cottonseed cake/maize offal, *Faidherbia albida*/maize offal, cottonseed cake/wheat offaland *Faidherbia albida*/wheat offal respectively. The supplements were offered 300g per head per day, twice every day, half at each time, i.e., 9:00am and 3:00pm. Water and salt lick were provided *ad libitum.* The

experiment lasted for 10 weeks after two weeks of adjustment to the experimental diets.

Procurement of experimental animals, management and experimental design

Thirty (30) growing Yankasa Rams with an average initial weight of 16.35 – 18.21 kg were procured for the study from Batsari and Kaita Local Government Local Livestock Markets, in Katsina State. Five (5) Yankasa rams were randomly allocated to six (6) diets, in individual face – in cubicles of 2 by 2 metres, housed in the same pen with slanted concreted floors, under a common roof. The house was fully illuminated, well ventilated and was sanitized periodically. Prior to the arrival of the rams, the cubicles were cleaned and disinfected with Diskol-ES (Tiscol) at the rate of 10mls/4litres of water. Also 10% formalin was used as a fumigant.

On their arrival, the rams were quarantined and adapted for two (2) weeks during which their bodies were sprayed with acaricide, using Amitraz® 1ml/litre against external parasites. They were dewormed with Albendazole at 12.5mg/kg[1] body weight against internal parasites. Antibiotic, i.e Oxytetracycline L. A. (Kepro®) 20%, at 1ml per 10kg body weight were injected intramuscularly. Groundnut haulms and maize offal were offered to the rams during the quarantine period and adaptation period of two (2) weeks before the commencement of the experiment. The design of the experiment is a completely randomized design (CRD) with five (5) rams allocated to six (6) diets each serving as a replicate.

Collection of blood samples

Blood samples were collected from the rams at the end of the feeding trial, at zero time (before morning feeding) and 4 hours after feeding. Five (5) mls of blood sample were drawn via jugular veins of the experimental rams using sterilized 19-gauge needle and syringe as described by Frandson (1986) into cleaned and well labeled sample bottles that contain an ethylene diaminetetra acetic acid (EDTA) coated plastic tube for haematological study. Mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC) content were calculated according to the procedures of Jain (1993). Packed cell volume and erythrocyte counts were determined as described in Egbunike and Nworgu (2006). Red blood cells (RBC) and differential total white blood cells (WBC) counts were carried out using Nuebauer haematocytometer after appropriate dilution according to Jelalu (2014).

Rumen liquor collection and analysis

An improvised suction tube (Bogoro, 1997) was used to collect rumen liquor as described by Menke and Steingass (1988). The rumen liquor was collected before feeding, 3 hours after feeding, and 5 hours after feeding at the last week of each experiment using a suction tube inserted from the mouth into the rumen where 50mls of rumen liquor was withdrawn from 3 Yankasa rams of each diet, they were made to fast overnight to enable liquor collection before feeding in the morning, this was placed in a calibrated gas tight plastic sy ringe fitted with a piston for storage and transportation (Babayemi & Bamikole, 2006). Samples were collected in a labelled and sterilised plastic sample bottles for each animal. The pH of the ruminal fluids collected were immediately recorded using an AGB – 75 laboratory pH – meter. The ruminal fluids were later analysed for total volatile fatty acids, (TVFA) and rumen liquor pH, according to Ziolecki and Kwaitokwoska (1975).

Table 1 shows normal range of haematological indices reported in literature. The normal range for packed cell volume (27.00 – 45%) and (28.90± 0.02 – 43.8± 2.33) reported for sheep

by Banerjee (2007), Njidda, Shu'aibu and Isidahomen (2014). Normal range for haemoglobin 9 – 15g/dl reported by Duncan and Prasse Manual (1986). Red blood cells 5.23± 1.0 - 7.80± 0.62g/dl reported by Njidda, Shu'aibu and Isidahomen (2014). White blood cells 4-12×$10^6$$mm^3$ reported for sheep by Plumb (1999). Mean corpuscular volume normal range 23 - 48fl for sheep (Plumb, 1999) and 38.00± 3.21 reported by Njidda, Shu'aibu and Isidahomen (2014) for sheep. Mean corpuscular haemoglobin the normal range is 8 – 12pg for sheep (Merck Manual, 2016).

Table 1: Normal ranges for blood haematological indices

Indices	Normal Ranges	Sources/References
Packed cell volume (PCV)	27.00 – 45% and (28.90± 0.02 – 43.8± 2.33	Banerjee (2007), Njidda, Shu'aibu and Isidahomen (2014)
Haemoglobin (Hb)	9 – 15g/dl	Duncan and Prasse Manual (1986)
Red Blood Cells (RBC)	5.23± 1.0 - 7.80± 0.62g/dl	Njidda, Shu'aibu and Isidahomen (2014)
White Blood Cells (WBC)	4-12×$10^6$$mm^3$	Plumb (1999)
Mean Corpuscular Volume (MCV)	23 - 48fl	Plumb (1999)
Mean Corpuscular Haemoglobin (MCH)	8 – 12pg	Merck Manual (2016).

Statistical analysis

The data collected from the study were subjected to Analysis of Variance (ANOVA) using general linear model of SAS (2002). Difference among means were compared at ($p<0.05$) using Duncan Multiple Range Test (DMRT, 1955) of the same statistical package.

Results and Discussion

Ingredients Composition of Supplements fed to Yankasa Rams

Table 2 shows the gross composition of the experimental dietary supplements. Treatment 1 contains 300 g cottonseed cake, treatment 2 contains 300 g *Faidherbia albida* pod meal, treatment 3 contains 150 g each of cottonseed cake and maize offal, treatment 4 contains 150 g each of *Faidherbia albida* pod meal and maize offal, treatment 5 contains 150 g each of cottonseed cake and wheat offal while treatment 6 contains 150 g each of *Faidherbia albida* pod meal and wheat offal respectively.

Table 2: Ingredients Composition of Supplements fed to Yankasa Rams in the Experiment

Ingredients (g)	Diets					
	T1 CSC	T2 FA	T3 CSC/MO	T4 FA/MO	T5 CSC/WO	T6 FA/WO
CSC	300.00	0.00	150.00	0.00	150.00	0.00
FA	0.00	300.00	0.00	150.00	0.00	150.00
MO	0.00	0.00	150.00	150.00	0.00	0.00
WO	0.00	0.00	0.00	0.00	150.00	150.00
Total	300.00	300.00	300.00	300.00	300.00	300.00

CSC = Cotton seed cake, FA = *Faiderbia albida* meal, MO = Maize offal, WO = Wheat offal

Chemical Composition of Supplements and Basal Diets Fed to the Rams

Chemical composition of urea treated and ensiled millet stover based diets with supplements fed to rams is presented in Table 3. The dry matter contents of the experimental feeds for all the treatment groups were within the range of 90.63 – 94.17%. The Crude Protein (CP) content of the experimental diets showed that supplemental diet 3 and 5 had the highest CP values of 31.16 and 27.88% respectively. The lowest CP was obtained on supplemental diet 2 with a CP value of 15.1%. Furthermore, the fibre fractions (NDF and ADF) of the diets were within range of 50% and below. The highest value was obtained on T2 which had 57.27% NDF and 31.15% in T4 ADF respectively. Hemicellulose values were high, with 29.08, 26.77, 18.47 and 16.5 for T1, T2, T3 and T5 respectively. More so, T6 and T4 recorded hemicellulose values, 12.87 and 11.65% respectively. Ash values in this study were within the range of 5.02 – 18.11%.

For the basal diets, urea treated and ensiled millet (UTEMS) recorded the lowest CP of 4.05%, non-treated millet stover (NTMS) had the highest value of 8.75%. High percentages of 40.05% NDF and 30.75% ADF were obtained in non-treated millet stover (NTMS) compared to lower ADF value (26.66%) and higher 48.98% NDF obtained in urea treated and ensiled millet stover (UTEMS). Also, hemicellulose values were higher 22.32% in urea treated and ensiled millet stover than (9.30%) in non-treated millet stover. The values of ash were lower in urea treated millet stover with 4.76 against 5.2% recorded in non-treated millet stover.

Table 3: Chemical Composition of Supplements and Basal Diets Fed to the Rams during the Experiment

Parameters	**Supplements**						**Basal (%)**
	T1 CSC	T2 FA	T3 CSC/MO	T4 FA/MO	T5 CSC/WO	T6 FA/WO	UTEMS
DM	92.01	94.17	93.46	91.31	92.87	90.63	48.71
OM	83.53	89.15	75.35	82.06	78.50	83.23	43.95
CP	27.88	15.1	31.16	19.13	27.88	16.95	4.03
Ash	8.48	5.02	18.11	9.25	14.37	7.40	4.76
NDF	50.39	57.27	39.43	42.80	39.25	39.25	48.98
ADF	21.31	30.50	30.96	31.15	22.75	22.75	26.66
Hemicel	29.08	26.77	18.47	11.65	16.50	16.50	22.32

D1 = CSC = Cotton seed cake sole, D2 = *Faidherbia albida* meal sole, D3 = CSC + maize offal, D4 = *Faidherbia albida* meal + maize offal; D5 = CSC + wheat offal; D6 = *Faidherbia albida* meal + wheat offal and UTEMS = Urea treated and ensiled millet stover; DM = Dry Matter; OM = Organic Matter; CP = Crude Protein; NDF = Neutral Detergent Fibre; ADF = Acid Detergent Fibre

Haematological Parameters of Growing Yankasa Rams fed Urea Treated and Ensiled Millet Stover Based Diets with Supplements

Increase in PCV values in this research after feeding, might be as a result of improved feeding as supported by findings of Etim *et al.* (2013) who reported that, increase in the percentage of PVC and Hb after feeding trial could be as a result of improved nutrition. The PCV values obtained in the present research are within normal range (27.00 – 45%) reported for sheep by Banerjee (2007). This indicated that PCV values of rams in this research were not affected ($p<0.05$) by the diets and were in on good plane of nutrition. The haemoglobin concentration (Hb) values in this research were within the range of 8.65 – 10.75g/dl reported by Garba and Abubakar (2012) of rams fed with tamarind leaves. The haemoglobin values reported in this research were within the normal range of 9 to 15g/dl reported by Duncan and Prasse Manual (2016). The Mean Corpuscular Volume (MCV) values obtained (24.65 – 39.44fl) were higher than 16.2fl reported for Yankasa Rams (Okunade *et al.*, 2015a).however, the MCV values obtained in the current study were within the normal range of 23 – 48fl for sheep (Plumb, 1999). The values for Mean Corpuscular Haemoglobin (MCH) in the present study after feeding are similar to 31.95 – 32.50 BF and higher than 41.75 – 43.80 AF for Yankasa sheep by Girgiri (2017), but are above 31 – 34, i.e. the normal range for sheep (Plumb, 1999). Mean corpuscular haemoglobin (MCH) for the present study were higher than 13.10 – 17.20pg before feeding and 13.75 – 14.30pg after feeding for Yankasa sheep by Girgiri (2017), higher than the normal range of 8 – 12pg for sheep (Merck Manual, 2016). This implies that the dietary feeds were rich nutitively which rendered the experimental animal to good plane of nutrition. MCH is very essential in the diagnosis of anemia in ruminants, the result in this study has indicated that the rams used were not anemic, therefore they are healthy.

The neutrophils values in this study are lower than 26.50 – 31.50% before feeding and 18.50 – 39.50% after feeding reported for Yankasa rams (Girgiri, 2017), lower than 44.75 – 62.25% reported for Red Sokoto goats fed *Moringa olifera* leaf meal supplement diets (Raji, *et al.*, 2016). The values obtained in this study were satisfactory and were in agreement with Mahgoub *et al.* (2004). The difference observed in neutrophils of this study with other studies reported might be attributed to breeds, age and types of feeds along with differences in geographical location used.

Lymphocytes values in this study were similar to 68.50 – 73.50 before feeding and 60.50 – 81.50 after feeding reported by Girgiri (2017) and 50 – 63.5 by Oni *et al.* (2012). The lymphocytes obtained in the current study are higher than the normal of 40 – 70% reported for sheep (Duncan and Prasse, 1986). The values in this research proved that there was absence of toxic substances which have adverse effects on blood formation.

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Table 3: Haematological Parameters of Growing Yankasa Rams fed Urea Treated and Ensiled Millet Stover Based Diets with Supplements

Parameters	Periods	Diets						SEM	LS
		T1 CSC	T2 FA	T3 CSC/MO	T4 FA/MO	T5 CSC/WO	T6 FA/WO		
Haem g/dl	Before Feeding	10.30^{a}	8.07^{b}	9.10^{a}	9.90^{a}	10.40^{a}	9.10^{a}	0.30	*
	4Hrs After Feeding	10.30^{c}	6.80^{b}	7.60^{b}	10.20^{a}	10.70^{a}	10.80^{a}	0.50	*
PCV	Before Feeding	17.73^{a}	13.83^{b}	18.80^{a}	17.50^{a}	18.30^{a}	16.93^{a}	0.50	*
%	4Hrs After Feeding	18.20^{b}	14.10^{c}	15.90^{bc}	17.10^{b}	22.60^{a}	16.10^{bc}	1.00	*
MCH	Before Feeding	19.81	20.12	16.79	19.60	19.62	18.57	0.40	NS
Pg	4Hrs After Feeding	18.26^{b}	11.89^{b}	13.33^{b}	17.80^{b}	18.67^{b}	18.85^{a}	0.83	*
MCV	Before Feeding	34.09	34.49	34.69	34.65	34.53	34.55	0.09	NS
Fl	4Hrs After Feeding	32.27	24.65	27.89	29.84	39.44	28.09	2.30	NS
MCHC	Before Feeding	58.09^{a}	58.35^{a}	48.40^{d}	56.57^{b}	56.83^{b}	53.75^{c}	1.10	*
g/dl	4Hrs After Feeding	56.59^{c}	48.23^{d}	47.79^{d}	59.65^{b}	47.35^{a}	67.08^{a}	0.01	*
WBC	Before Feeding	6.90^{a}	5.30^{c}	4.70^{d}	5.40^{b}	4.90^{d}	5.70^{c}	0.50	*
$\times 10^{9}$/L	4Hrs After Feeding	6.90^{a}	5.30^{b}	3.10^{c}	5.60^{b}	4.60^{bc}	5.70^{ab}	0.40	*
PLAT	Before Feeding	1686.70^{b}	1678.0^{c}	1334.70^{d}	2012.00^{a}	1900.0^{a}	1947.3^{a}	121.9	*
$\times 10^{9}$/L	4Hrs After Feeding	1627.50	1258.00	680.5	1426.50	1133.00	897.0	337.9	NS
ESR	Before Feeding	1.00	1.00	1.00	1.00	1.00	1.00	0.18	NS
mm/hr	4hrs After Feeding	1.00^{ab}	1.33^{a}	0.67^{b}	1.00^{ab}	1.00^{ab}	1.00^{ab}	0.18	*
NEUT	Before Feeding	10.20^{bc}	5.70^{c}	9.80^{bc}	21.07^{a}	12.90^{b}	7.90^{bc}	1.40	*
%	4Hrs After Feeding	20.20^{ab}	17.30^{abc}	11.10^{bc}	9.80^{c}	9.70^{c}	21.90^{a}	2.70	*
EOSIN	Before Feeding	0.03^{c}	0.30^{a}	0.23^{ab}	0.27^{ab}	0.10^{bc}	0.20^{abc}	0.03	*
%	4Hrs After Feeding	0.10^{c}	0.30^{b}	0.15^{bc}	0.30^{b}	0.30^{b}	1.00^{a}	0.04	*
BASO	Befrore Feeding	6.10^{a}	0.60^{b}	0.50^{b}	1.90^{b}	0.93^{c}	0.40^{b}	0.60	*
%	4Hrs After Feeding	1.10^{b}	1.50^{a}	1.10^{b}	0.50^{e}	0.80^{d}	0.90^{c}	0.04	*
LYMP	Before Feeding	88.70^{ab}	92.10^{a}	88.10^{ab}	76.30^{c}	85.70^{b}	90.40^{ab}	1.50	*
%	4Hrs After Feeding	78.10^{bc}	80.60^{abc}	87.33^{ab}	89.10^{a}	89.00^{a}	76.00^{c}	2.70	*
MONO	Before Feeding	8.30^{c}	8.50^{a}	8.50^{a}	8.50^{a}	8.43^{ab}	8.50^{a}	0.03	*
%	4AfterFeeding	8.50^{a}	8.50^{a}	8.33^{bc}	8.40^{b}	8.40^{b}	8.20^{c}	0.04	*
RBC	Before Feeding	5.20^{a}	4.01^{b}	5.42^{a}	5.05^{a}	5.30^{a}	4.90^{a}	0.14	*
$\times 10^{12}$/L	4Hrs After Feeding	5.64^{c}	5.72^{a}	570^{b}	5.73^{a}	5.73^{a}	5.73^{a}	0.14	NS

D1 = Cotton Seed Cake alone; D2 = Gawo Meal alone; D3 = Cotton Seed Cake + Maize Offal; D4 = *Faidherbia albida* meal + Maize Offal; T5 = Cotton Seed Cake + Wheat Offal; D6 = *Faidherbia albida* meal + Wheat Offal; SEM = Standard Error of Means, LS = Level of Significance, NS = Not Significant; * = (P<0.05); HAEM = Haemoglobin; PCV = Packed cell volume; MCH = Mean corpuscular haemoglobin; MCV = Mean corpuscular volume; MCHC = Mean corpuscular haemoglobin concentration; WBC = White blood cells; PLAT = Platelets; ESR = Erythrocytes sedimentation rates; NEUT = Neutrophils; BASO = Basophils; LYMPHO = Lymphocytes; MONO = Monocytes; RBC = Red blood cells.

Rumen short chain fatty acids and pH of yankasa rams fed urea treated and ensiled millet stover based diets with supplements

Rumen pH before feeding was significantly ($p<0.05$) affected by the diets. However, there was general decrease in pH after feeding across the diets. It was observed in this study that rumen pH values decreased 3hours and 5hours after feeding in D4, also similar trend was maintained from D1 – D5, which agrees with the report of Girgiri (2017) who observed a decrease in pH value range before and 4 hours after feeding as 5.75 – 7.45 and 5.10 – 6.95. The pH values recorded before feeding in this study were within range of values 6.5 reported by Khan *et al.* (2005) but lower than the study conducted by Hamad *et al.* (2010) who reported 7.43. The values of rumen liquor pH in this study is in agreement with observations made by Orskov (1990) who reported that cellulolytic bacteria require pH of 6.2 – 7.0 which were optimal for microbial growth when rams are fed on roughages, as such normal rumen pH implies that volatile fatty acids which are by-products of fermentation rapidly diffused through the rumen wall instead of accumulating within the rumen.

The total volatile fatty acids in this study were within range of 73.85 – 85.3% by Thalib *et al.* (2010), 86.2 91.9% by Davies, MCkinna and Mutsvangwa (2012) and were also similar with 42.40 – 81.40 except for D3 which was higher than that of present study. The TVFA values obtained in this study were higher than 8.08 BF and 10.12% AF reported by Tawila *et al.* (2008), 6.07 – 7.34% BF and 8.91 – 10.25 AF reported by Hamad *et al.* (2010), 20.50 – 10.00% reported by Hassan *et al.* (2016) and 9.18, 9.93 and 9.52% BF and 9.96, 10.61 and 11.59% AF reported by Girgiri (2017). According to observation made by Akinbode *et al.* (2020) that significant variations ($p<0.05$) in total volatile fatty acids (acetate, propionate and butyrate) across diets could be as a result of increase in nitrogen source

Table 4: Rumen Short Chain Fatty Acids and pH of Yankasa Rams Fed Urea Treated and Ensiled Millet Stover with Supplements

Parameters	Periods	Diets						SEM	LS
		1 CSC	2 FA	3 CSC/MO	4 FA/MO	5 CSC/WO	6 FA/WO		
pH	BF	7.07^{b}	8.40^{a}	5.40^{cd}	9.10^{a}	6.80^{c}	6.80^{c}	0.31	*
	3hrs AF	7.60^{b}	9.30^{a}	8.97^{a}	6.20^{c}	9.30^{a}	7.00^{bc}	0.32	*
	5hrs AF	5.30^{cd}	8.40^{a}	5.30^{cd}	5.20^{d}	7.40^{b}	8.20^{ab}	0.40	*
TVFA	BF	38.30^{bc}	30.43^{d}	44.03^{a}	36.60^{c}	33.00^{cd}	38.70^{b}	2.00	*
	3hrs AF	34.33^{b}	41.13^{a}	36.60^{ab}	50.00^{a}	42.50^{ab}	33.13^{b}	1.99	*
	5hrs AF	35.43^{c}	41.30^{ab}	39.83^{bc}	36.17^{b}	43.97^{ab}	49.30^{a}	1.80	*

D1 = Cotton Seed Cake alone; D2 = *Faidherbia albida* meal alone; D3 = Cotton Seed Cake + Maize Offal; D4 = *Faidherbia albida* meal + Maize Offal; T5 = Cotton Seed Cake + Wheat Offal; D6 = *Faidherbia albida* meal + Wheat Offal; BF = Before Meal; 3AF = Three Hours after Meal; 5AF = Five Hours after Meal; TVFA = Total Volatile Fatty Acids; LSD = Least Significant; Difference NS = Non Significant ($P<0.05$).

Conclusion

Based on the results obtained in this research, it was concluded that rams fed with *Faidherbia albida* and maize offal at 50:50 percent has better pH of 5.0 to 9.10 before and after feeding, total volatile fatty acids 36.60 to 5.00 before and after feeding as well as better haemtological parameters like haemoglobin that ranged from 5.05 to 5.73 all before and after feeding the diets respectively, as such could be recommended for feeding Yankasa rams as supplemental diets, in that all the haematological indices are within normal range for healthy rams.

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