



SERUM BIOCHEMICAL INDICES AND RUMEN METABOLITES OF GROWING YANKASA RAMS SUPPLEMENTED WITH MILLET STOVER BASED SUPPLEMENTS WITH FEED ADDITIVES DURING EARLY RAINING SEASON GRAZING

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ABSTRACT

The experiment was conducted to investigate the response of growing Yankasa rams to urea-treated or untreated millet Stover based supplements during early raining season grazing on haematological parameters and rumen metabolites. A total of 20 Yankasa rams were used for the experiments in a completely randomized design with five treatments of four animals each in replicate. Five different supplements were formulated to contain 12% CP from urea-treated or urea untreated millet Stover and other ingredients with feed additive. Supplement 1 had urea untreated millet stover, while 2, 3, 4 and 5 contained urea-treated millet stover at 1, 2, 3, and 4% respectively with feed additive in experiment 4. Animals were offered their respective supplement at 400g per head per day (200g each in the morning and evening) and thereafter allowed to graze the available forages. The experiments lasted for 84 days. Result of the experiment revealed RBC and MCH differs significantly ($P < 0.05$) across the diets. Rumen $\text{NH}_3\text{-N}$ was significantly ($P < 0.05$) higher 51.34 and 61.18 mg/dl before and after feeding in animals fed supplement 1 than 42.06 and 52.66 mg/dl in that fed supplement 4 respectively. It is therefore concluded that all supplements had no detrimental effect on blood and rumen parameters. It is recommended that supplement with urea-untreated millet stover can be fed to Yankasa rams during raining season.

Keywords: Supplements, Yankasa rams, Millet Stover, Feed additive, Ruminal fermentation.

INTRODUCTION

Ruminants in the tropics in general, are raised predominantly on grass which are inherently poor in digestibility, nutritive value and unavailability in off season (Babayemi *et al.*, 2009). There is a seasonal variation in availability of natural pasture, pasture tends to be more succulent, highly nutritious and more abundant in towards the end of raining season as opposed to the dry season around November to April (Lamidi and Ologbose, 2014). For better utilization of urea treated roughages, some amount of protein supplementation should be present in the feed, part of which can be provided by energy sources, and frequently some oil meals are used in preparing the formula feeds (Ensminger, 2002).

During the rainy season, tropical grasses present faster growth and greater nutritive value compared to the dry season. Nevertheless, regarding improved animal performance, the utilization of the nutrients from pastures during rainy season is not considered to be optimal (Figueiras *et al.*, 2016). One of the most critical periods for forage availability in the savannah region of Nigeria lies between April and June when shortages are most likely to occur (van Raay and de Leeuw, 1974; Abubakar *et al.*, 2010). According to Abubakar *et al.* (2010), during



the onset of rains growth of a limited number of high nutritive value grasses whose quality declines progressively as the seasons advances toward the dry season.

Majority of farmers in the developing countries cannot afford conventional feedstuff such as cotton seed cake due to non-availability and high cost (Abubakar *et al.*, 2010). The nutritional evaluation of tropical grasses under grazing during the rainy season indicates an unbalanced energy-to protein ratio exists, with a relative excess of energy. Therefore, supplementation programs should focus primarily on the establishment of a dietary balance by increasing protein content in the diet (Figueiras *et al.*, 2016). Paulino *et al.* (2008) suggested that potential improvement in weight gain could be obtained by using a correct supplementation program. Urea supplementation to low quality feeds has been shown to increase the rumen availability of nitrogen which in turn increases the rumen availability of nitrogen which in turn increase the rumen degradation and energy intake in ruminant (Adegbola, 2002; Abebe *et al.*, 2004; Abubakar *et al.*, 2010).

Concentrate feeds such as roughage-based supplement can be used during raining season when pasture is high in moisture for livestock consumption (Lamidi and Ologbose, 2014). Supplementation during the rainy season should focus primarily on protein feed ingredients (Detmann *et al.*, 2014; Lazzarini *et al.*, 2016). The experiment was therefore aimed to investigate the response of growing Yankasa rams to urea-treated or untreated millet Stover based supplements during early raining season grazing on haematological parameters and rumen metabolites.

MATERIALS AND METHODS

The Study Area

The experiment was conducted at Demonstration Farm, College of Education Gumel, Jigawa, Nigeria. The town is situated some 127 km Northeast of Kano State, Nigeria and lies about 26 km south of Nigeria's boarder with Niger Republic. The town is situated at 12°37' 51" North latitude, 9° 23' 36" East longitude and 361 meters elevation above the sea level and 361 meters elevation above the sea level with average rainfall of 369 mm annually (www.maplandia.com)

Experimental Animals and Management

Twenty (20) growing Yankasa rams each with an average weight of 18.38 kg were used for experiment respectively. The animals were quarantined for two weeks before adaptation. During this period the animals were fed with groundnut haulms and maize offal, dewormed with Albendazole and injected with Ivermectin for both internal and external parasites followed by broad spectrum antibiotic injected intramuscularly. The animals were randomly allocated to five treatments of four animals each in a completely randomized designed. The animals were housed in individual pens of 2 by 2 meters with slanted concreted floors under a common roof.

Experimental Diets and Animal Feeding

Five supplement diets containing 12% crude protein with Runamix® premix were formulated. The supplements designated as 1,2,3,4 and 5 contained urea treated or untreated millet stover with wheat offal, sorghum panicle, cotton seed cake, molasses, bone meal and salt as presented in Table 1 with chemical composition. Diet 1 contains urea untreated millet stover while 2, 3, 4 and 5 contain urea treated millet stover at 1, 2, 3, and 4%, respectively. Each ram was offered their respective supplementary diets at 400g per head per day (200g each in the morning and evening) at about 7:00 am; they were allowed to consume the feed for one hour (7:00 am to 8:00 am) and thereafter allowed to graze the available forages at the college grazing area for about six hours (10:00 am to 4:00 pm) in order to obtain their basal diets. Feed refusals



were collected and weighed immediately after the rams were released for grazing. On returning from grazing, they were kept in their individual pens. Clean drinking water was provided *ad libitum* for the duration of the experiment.

Tables 1: Ingredients and chemical composition of supplemental diets

Ingredients	Diets				
	1	2	3	4	5
Wheat offal	23.33	29.56	35.78	42.01	48.24
Sorghum panicle	39.15	35.42	31.69	27.96	24.24
Cotton seed cake	10.00	7.50	5.00	2.50	0.00
Millet stover	20.00	20.00	20.00	20.00	20.00
Molasses	5.00	5.00	5.00	5.00	5.00
Bone meal	2.00	2.00	2.00	2.00	2.00
Salt	0.50	0.50	0.50	0.50	0.50
Runamix	0.03	0.03	0.03	0.03	0.03
Total	100.00	100.00	100.00	100.00	100.00
Parameters					
Dry Matter	96.48	96.5	95.71	94.33	93.95
Organic Matter	84.88	87.53	89.59	87.92	88.70
Crude Protein	12.07	12.06	12.03	12.09	12.00
Ash	11.60	8.97	6.12	6.41	5.25
Neutral Detergent Fibre	34.39	33.17	32.51	31.73	30.09
Acid Detergent Fibre	24.47	22.45	19.22	19.8	17.63
Hemicellulose	9.92	10.72	13.29	11.93	12.46

S1=Supplement with urea untreated millet stover, S2= Supplement with urea treated millet stover at 1%, S3= Supplement with urea treated millet stover at 2%, S4= Supplement with urea treated millet stover at 3%, S5= Supplement with urea treated millet stover at 4%

Rumen Metabolites Study

Rumen liquor were collected from three animals each per treatment at 0 hour before feeding and 5 hours after feeding during the last week of the experiments. The animals were held on their fore legs and rear legs on the ground in a standing position and a suction tube was inserted from the mouth in to the rumen where 20mls of rumen liquor were withdrawn. The pH of each sample was taken immediately by pH meter. The rumen liquor collected were strained through layers of surgical gauge to remove particulate matter and taken to laboratory for the analysis of total volatile fatty acids, individual volatile fatty acids and rumen ammonia-nitrogen.

Haematological and Biochemical Study

Blood samples was collected via jugular veins of the selected three animals per treatment during the last week of experiments. The blood samples were collected for haematological and biochemical analysis. For haematological study, blood was collected in sample bottles with Ethylene Diamine tetra Acetic Acid (EDTA). Haemoglobin (Hb) concentrations, white blood cells (WBC) and red blood cells (RBC) were determined according to the method described by Bush (1975). Mean corpuscular volume (MCV), mean corpuscular haemoglobin concentration (MCHC), mean haemoglobin concentration (MHC) will be calculated according to the method described by (Schalm *et al.*, 1985) and packed cell volume (PCV) by (Baker *et al.*, 1985). For serum biochemical study, blood was collected in plane



sample bottles without Ethylene Diamine tetra Acetic Acid (EDTA) for harvest of blood serum biochemical analysis. Total protein, blood urea nitrogen, blood glucose was measured 0 hour before and 5 hours after feeding.

Analytical analysis

Proximate and chemical analyses of feed samples were done according to the procedures of AOAC (2000) and the method of Van Soest *et al.* (1991) was used to determine neutral detergent fiber and acid detergent fiber contents.

Experimental design

The experiment was conducted in a Completely Randomized Design (CRD) with five (5) treatments of four (4) animals each (Steel and Torrie, 1980)

Statistical Analysis

Data generated were subjected to analysis of variance (ANOVA) using MINITAB 16 (2014). Where analysis of variance indicates a significant difference, means were separated using Duncan's new multiple range test (DMRT).

RESULTS AND DISCUSSION

Results for haematological and serum biochemical indices of growing Yankasa rams supplemented with urea-treated or untreated millet Stover based supplements with feed additive during early raining season grazing is shown in Table 2. The Haemoglobin (Hb) concentration range of 9.50 to 10.15g/dl obtained in this study was in accordance with the range of 9.11 to 9.87 g/dl reported by Alabi and Ososanya (2017). Ayele *et al.* (2017) reported Hb value of 11.10 g/dl, which was higher than the value in this study. The range of Hb in this study fell within 9.0 to 15.0 g/dl reported by Patra *et al.* (2003). The values of 8.25 to 11.30 g/dl reported by Sani (2018) were within the range values of this study. The values obtained in this study were within the normal haemoglobin range of 9.00 to 15.00g/dl for sheep as reported by Merck (1998).

The Packed cell volume range of 27.00 to 33.50% recorded in this study was consistent with the range of 29.20 to 30.02% reported (Alabi and Ososanya, 2017). Ayele *et al.* (2017) reported PCV of 37.40%, which was higher than the figure recorded in this study. It was below the range of 35.70 to 39.10% reported by Sani (2018) and falls within the range of 20.10 to 48.00% reported by Jawasreh *et al.* (2010).

The white blood cells (WBC) range of 10.30 to 11.85×10^9 recorded in this study was higher than the range of 7.80 to $8.70 \times 10^9/L$ obtained by Sani (2018), but falls within the values of 3.2 to $15.80 \times 10^9/L$ reported Jawasreh *et al.* (2010). Ayele *et al.* (2017) reported WBC count of 13.8×10^9 , which was higher than the figure recorded in this study. The WBC counts in this study fall within the range of 5 to 11 g/dl reported by Scott *et al.* (2006) for sheep.

The higher RBC values of 9.54 and $9.33 \times 10^9/l$ recorded in this study were similar to the range of 8.33 to $9.36 \times 10^9/L$ reported by Sani (2018). Ayele *et al.* (2017) reported RBC count of 13.8×10^9 , which was higher than the figure obtained in this study. The values in this study also fall within the range of 9.2 to $13.5 \times 10^9/L$ reported by Tambuwal *et al.* (2002). Similarly, the RBC count in this study was not in conformity with the value $4.00 \times 10^9/L$ reported by Asaolu *et al.* (2012). The RBC count values in this study falls within the range of 9.9 to 18.7 g/dl documented by Taiwo and Ogunsanmi (2003)

The observed figure of 34.07 to 42.82% MCV of in this study was within the 23 to 48 fl reported by Vojta *et al.* (2011). The values recorded in this study were within the range of 28 to 40 fl observed by Banerjee (2007) for sheep. Ayele *et al.* (2017) reported MCV of 29.70 fl, which was in accordance with the figures recorded in this study



The value of 13.78 pg MCH recorded in this study was below the range of 35.70 to 39.85 pg reported by Garba and Adeola (2020) for Yankasa sheep. The range of 3.01 g/L to 3.05 g/L MCHC recorded in this study was consistent with the value of 30.0 g/dl reported by Ayele *et al.* (2017).

The range of 6.45 to 7.75 g/L total protein 0 hours before feeding in this study falls within the range of 5.40 to 8.30 g/dl reported by Sani (2018). The values of 6.25 and 6.85 g/L total protein 5 hours after feeding in this study was within the range of 6.00 to 7.65 g/dl reported by Sani (2018).

Total glucose value of 4.45 mmol/l recorded 0 hours before feeding in this study was higher than the range of 2.70 to 3.70 mmol/l reported by Sani (2018). Total glucose value of 5.05 mmol/l recorded for 5 hours after feeding in this study was higher than the range of 2.85 to 3.75 g/dl reported by Sani (2018) and 2.50 to 3.90 g/dl reported by Davies *et al.* (2007).

The blood urea values recorded for 0 hours before feeding in this study range from 3.45 to 6.45 mmol/l, which was lower than the range of 6.90 to 8.90 mmol/l reported by Sani, (2018). Higher value of 7.85 mmol/l of blood urea 5 hours after feeding in this study was lower than the range of 8.55 to 9.40 mmol/l reported by Sani (2018). These values fall within the range of 0.8 to 9.2 mmol/l reported by Daramola *et al.* (2005) who fed West African Dwarf goats with supplements.

Table 2: Haematological and biochemical indices of Yankasa rams supplemented with urea-treated or untreated millet Stover based supplements with feed additives

Parameters	Supplements					SEM
	1	2	3	4	5	
Haematological						
Hemoglobin (g/dl)	9.90	8.90	8.95	10.15	9.50	0.27 ^{NS}
Packed cell volume (%)	32.50	29.50	27.00	33.50	31.60	1.26 ^{NS}
White blood cell (x10 ⁹ /L)	11.85	11.15	10.30	10.95	10.80	0.38 ^{NS}
Red blood cell (x10 ⁹ /L)	9.54 ^a	8.36 ^b	6.49 ^d	9.33 ^a	7.38 ^c	0.42 [*]
MCV (fl)	34.07	35.29	41.6	35.91	42.82	1.73 ^{NS}
MCH (pg)	10.38 ^c	10.65 ^c	13.79 ^a	10.88 ^c	12.87 ^b	0.49 [*]
MCHC (g/L)	3.05	3.02	3.31	3.03	3.01	0.08 ^{NS}
Biochemical						
Total protein (g/L)						
0 hours (before feeding)	6.45	7.75	7.40	6.65	7.10	0.26 ^{NS}
5 hours (after feeding)	6.25 ^c	6.85 ^c	7.95 ^a	7.05 ^b	7.15 ^b	0.18 [*]
Total glucose (mmol/L)						
0 hours (before feeding)	3.75 ^b	4.45 ^a	3.15 ^{bc}	2.80 ^c	3.90 ^b	0.22 [*]
5 hours (after feeding)	4.05 ^b	4.95 ^a	4.05 ^b	3.05 ^c	5.05 ^a	0.24 [*]
Urea (mmol/L)						
0 hours (before feeding)	6.45	4.70	4.00	3.45	4.55	0.45 ^{NS}
5 hours (after feeding)	7.85 ^a	7.05 ^b	3.15 ^d	3.95 ^c	7.05 ^b	0.63 [*]

^{a,b}Means within each row with different superscripts are significantly different, *(P<0.05), 1=Supplement with urea untreated millet stover, 2= Supplement with urea treated millet stover at 1%, 3= Supplement with urea treated millet stover at 2%, 4= Supplement with urea treated millet stover at 3%, 5= Supplement with urea treated millet stover at 4%, PCV= Packed Cell Volume; WBC= White Blood Cells; MCH=Mean Corpuscular Haemoglobin; MCHC= Mean Corpuscular Haemoglobin Concentration; MCV= Mean Corpuscular Volume; RBC= Red Blood Cells, SEM standard error mean, NS= Not significant.

The result of rumen metabolites parameters of growing Yankasa rams on grazing supplemented with urea-treated or untreated millet Stover based supplement with additive was presented Table 3. Ruminal pH values of 6.77 was obtained 0 hour before feeding and 6.37 to

6.77 after feeding in this study fell within the range of 6.44 to 7.09 documented by Jokthan *et al.* (2013). Rumen pH range from 6.2 to 7.2 reported to be optimal for microbial activities by Van Soest (1994). The concentration of TVFA 87.33 to 89.40 mmol/l 0 hour before and after feeding recorded in this study were within the range of 31 to 196 mmol/L documented by Woyengo *et al.* (2004) and the normal range of 70 to 150 mmol/L by McDonald *et al.* (1995). The recorded values from this study were greater than 15.33 mmol/dl reported by Jokthan *et al.* (2013) and 13.10 mmol/dl recorded for Yankasa rams fed with sun dried broiler litter (SDBL) by Abubakar *et al.* (2010). The TVFA concentration in this study fell within range of 91.30 to 107.00 documented by Ismartoyo (2017).

Table 3: Rumen metabolites of Yankasa rams on grazing supplemented with urea-treated or untreated millet Stover based supplements with feed additives

Parameters	Supplements					SEM
	1	2	3	4	5	
Ph						
0 hours (before feeding)	5.97 ^e	6.67 ^c	6.17 ^d	6.77 ^b	6.77 ^a	0.11*
4 hours (after feeding)	6.67	6.77	6.77	6.37	6.67	0.08 ^{NS}
TVFA (mmol/L)						
0 hours (before feeding)	77.95 ^c	83.30 ^b	89.40 ^a	89.37 ^a	87.33 ^a	1.21*
4 hours (after feeding)	103.30 ^a	90.42 ^b	89.29 ^b	80.85 ^c	73.93 ^d	2.66*
Acetate (mmol/L)						
0 hours (before feeding)	36.80 ^d	40.92 ^c	43.79 ^a	42.36 ^b	44.29 ^a	0.73*
4 hours (after feeding)	50.83 ^a	40.61 ^b	40.55 ^b	36.66 ^c	33.17 ^d	1.59*
Propionate (mmol/L)						
0 hours (before feeding)	27.10 ^c	28.28 ^b	30.42 ^a	30.91 ^a	29.03 ^b	0.39*
4 hours (after feeding)	35.08 ^a	32.33 ^b	31.74 ^b	28.39 ^c	26.43 ^d	0.82*
Butyrate (mmol/L)						
0 hours (before feeding)	14.05 ^b	14.09 ^b	15.19 ^a	16.09 ^a	14.00 ^b	0.25*
5 hours (after feeding)	17.40 ^a	17.49 ^a	17.00 ^b	15.81 ^b	14.34 ^c	0.34*
NH₃-N (mg/L)						
0 hours (before feeding)	51.34 ^a	45.30 ^c	48.43 ^b	42.06 ^e	44.57 ^d	0.86*
4 hours (after feeding)	61.18 ^a	56.71 ^c	60.62 ^b	52.66 ^e	55.79 ^d	0.85*

a,b,c,d Means within each row with different superscripts are significantly different* ($P < 0.05$), 1=Supplement with urea untreated millet stover, 2= Supplement with urea treated millet stover at 1%, 3= Supplement with urea treated millet stover at 2%, 4= Supplement with urea treated millet stover at 3%, 5= Supplement with urea treated millet stover at 4%, SEM standard error mean, NS= Not significant, TVFA= Total volatile fatty acids.

As presented in Table 3, the molar proportions of acetate before and after feeding were 44.29 mmol/l and 50.83 mmol/l and fell within the range of 14.00 to 56.11 mmol/l and 47.8 to 56.4% molar proportions of TVFA documented by Abdullahi (2021) and Woyengo *et al.* (2004). The acetate concentrations in this study were below the range of 59.40 to 72.90 reported by Ismartoyo (2017). The propionate concentration of 30.42 and 30.91 in ruminal fluid before and 35.08 mmol/l after feeding documented in this study were within the range of 39.16 to 70.15 mmol/l for Yankasa supplemented with Groundnut cake fed with treated sesame basal diet and above the range of 12.5 to 18.9% documented by Abdullahi (2021) and Woyengo *et al.* (2004). The propionate concentration in this study was above the range 23.80 to 28.80 reported by Ismartoyo (2017). The butyrate concentrations (15.19 and 16.09 mmol/l) and (17.40 and 17.49 mmol/l) before and after feeding obtained in this study disagree were above



the range of 9.7 to 13.5% documented by Woyengo *et al.* (2004). The concentration 51.34 and 61.18 mg/dl of ruminal $\text{NH}_3\text{-N}$ before and after feeding in this study fell within the range of 9 to 234 mg/L documented by Woyengo *et al.* (2004). The rumen $\text{NH}_3\text{-N}$ concentration in ruminal fluid for all diet were within the range of 40 to 250 mg/L reported by Erdman *et al.* (1986) to be optimal for digestion depending on the potential digestibility of feed. The value reported was also higher than the range of 14.50 to 27.60 reported by (Singh *et al.* 2010)

CONCLUSION AND RECOMMENDATIONS

It is therefore concluded that all supplements had not detrimental effect on blood and rumen parameters. It is recommended that supplement with urea-untreated millet stover can be fed to Yankasa rams during raining season.

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