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Serum Biochemical Profiles of Growing Yankasa Rams Fed Urea Ensiled Millet Stover Based Diet with Different Supplements

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Abstract
An experiment was conducted for a period of 90 days to evaluate the effect of feeding urea ensiled millet stover based diet with different supplements on the serum profiles of growing Yankasa rams. Thirty (30) growing Yankasa rams of mean initial body weights of 16.35 - 18.21 kg were allotted to six dietary treatments with five (5) animals per treatment in a Completely Randomized Design. Four kg urea were dissolved in 100 litres of water sprinkled on 100kg of crushed millet stover and ensiled for 21 days was used as roughage diet. A concentrate diet consisting of 300g of sole cotton seed cake diet 1, Faidherbia albida meal diet 2, CSC & maize offal diet 3, FA & maize offal diet 4, CSC & wheat offal diet 5 and FA & wheat offal diet 6, all fed twice daily at 4.0% of individual body weight. Blood samples were collected and analysed for serum parameters. Data generated were subjected to analysis of variance and differences in means were compared using Duncan's Multiple Range Test. Significant differences (P<0.05) were observed on conjugated bilirubin, alanine phosphate, urea nitrogen and total bilirubin. The serum urea nitrogen, sodium ion, potassium ion, total bilirubin, conjugated bilirubin and total protein values ranged from 3.20 to 8.40 mg/dl, 139.67 to 150.00mmol, 4.93 to 5.70 mmol 0.20 to 5.60 mmol, 0.04 to 2.50 mmol and 66.00 to 70.00 g/l, respectively. The results of this study suggested that ensiled millet stover with supplements can be fed to growing Yankasa sheep without deliterious effects on biochemical indices and Similarly, FA:WO 50:50 diet recorded the best in all the parameters measured and could be recommended for growing Yankasa sheep. It is concluded that, diet containing urea ensiled millet stover had no detrimental effect on the serum profiles of growing Yankasa rams as they were in the recommended normal ranges.

Key words*: Growing Yankasa rams, urea ensiled millet stover, Serum Biochemical profiles and Faidherbia albida*

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I. Introduction

Majority of ruminant livestock in tropical Africa are raised on natural pastures which decline rapidly in quality during the dry season (Ajayi, 2007) and limited amount of forage will be available that usually comprises of mature and fibrous grass or crop residue, which do not provide the minerals and protein needed to catalyse rumen fermentation and maintain the health of rumen microbes (Leng, 2003). In most developing nations, particularly those within arid and semiarid regions of sub-Saharan West Africa, livestock production is affected by seasonal variation in the availability and quality of pastures (Castrillo, Jimenez, Osornio, Lopez, Aguilar & Castrillo, 2003). According to Akinola, Abubakar, Shehu and Abdoulaye (2015) cereal crop residues are given less attention as important livestock feed, where over 40% is used as fuel while only about 27.28% is used as animal feed. Therefore, ruminant animals 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 (Deaville, Angela & Givens, 1994), as dry season nutritional stress is a major constraint to ruminant livestock production in semi-arid regions (Smith, Hill & Broster, 1980), in that when the rain ceases the quantity and quality of grazing falls rapidly so that dry season grazing is fibrous and low in crude protein around 2% (Owen & Aboud, 1998).

At the beginning of the rains in April – May, there is growth of a limited number of a high nutritive value grasses whose quality declines progressively as the season advances to the dry season, deficiencies of

minerals especially phosphorus and carotene have also been reported (Umunna & Agishi, 1988).As a result of the nutritive status of available forages on which most livestock depend, livestock suffer weight losses considerably and impairment of the other productive functions and in some cases resulting in death of animals offered poor quality roughage without supplementation (Shehu, 1994).

Millet Stover is the part of the plant that remains after the grains are harvested, and is a fibrous by-product that contains low nutritive value (Hassanat, 2007). Millet stover can be fed to sheep. Urea treatment enhances its palatability and total digestible nutrients (Choudhary, Marthur, Ajay & Singh, 2004). Stover ammoniation (4%) is advisable as it enhances dry matter (DM) intake, crude protein (CP), and crude fiber (CF) digestibility by more than 10% in a pearl millet stover concentrate based-diet (Ramana, Krishna, Parsatharathy & Prasad, 1989). According to Subba Rao *et al.* (1995) treating millet stover with 4% urea using maximum of 100 litres of water per 100kg air dry straw in long form, storing it under airtight condition for a period of 1-3 weeks, improves palatabilty, energy and protein content. Due to its high palatability and nutritive value, farmers use the stovers almost exclusively for feeding cattle (Subba Rao *et al.*, 1995). Treating millet stover with a 5% urea solution increases dry matter (DM) digestibility by 23% dry matter intake by 16% (from 42.6 to 49.2g/kg W0.75) and average daily gain by 12% (from 41 to 51g/kg) in Djallonke rams (Mattoni *et al.*, 2007).In this study, an attempt was made to evaluate the effects of feeding urea treated and ensiled millet stover based diets with different supplements on serum biochemical profiles of growing Yankasa rams.

II. Materials and Methods Study Area

The experiment was conducted at the Teaching and Research Farm, in the Small Ruminant Unit of the Federal University Dutsinma, Katsina State. The State is located between latitudes 12˙.985531^{o}'N and longitudes 7.617144^{o}E (Nkromah, 2007). It covers an estimated land area of about 24,192 square kilometers (9,341 square miles) (Nkromah, 2007).

Dutsinma LGA lies on latitude 12^{0} 27'16.128'N and longitude 07^{0}29'5544E. It has a land area of about 527, km^{2} (203sq miles). It has an elevation of about 605m (1,985 ft.), with a population of 167,671. The inhabitants are predominantly Hausa and Fulani by tribe. Their main occupation is crop production and animal rearing (Katsina, 2006).

The weather varies according to the season of the year. The hottest months are March to May with maximum temperature ranging from 29^{o}C to 38^{o}C. The wind is dry from January to April, signalling the arrival of the rainy season, which lasts from May to September. The mean annual rainfall ranges from 400 to 1300mm (KTARDA, 2001).

Source of Test Ingredients: The ingredients used for the formulation of both basal and supplemental diets include: urea, millet stover, wheat offal, maize offal and cottonseed cake. Urea for the experiment was purchased from Katsina metropolis, Katsina State, Nigeria. *Faidherbia albida* pods were purchasd in Yandaki town of Kaita Local Government of Katsina State.

Preparation of Experimental Diets Two experimental diets were prepared for the study: basal and concentrates.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 spread on a polythene sheet for a period of one hour to allow for escape of excess ammonia. This served as the basal diet of the experiment. The basal diet was fed to the rams, *ad libitum*

Six concentrate diets were formulated using cotton seed cake, *Faidherbia albida* meal, maize offal and wheat offal. The concentrates were formulated in such a way that each diet contained one or a combination of either of the two protein and energy sources (CSC or FA & MO or WO). The concentrates designated as 1, 2, 3, 4, 5 and 6 contained CSC, FA, CSC/MO, FA/MO, CSC/WO and FA/WO respectively.The ingredients were appropriately weighed using digital and manual scales. All lumps of cottonseed cake and *Faidherbia albida* were broken using mortar and pestle to ensure proper mixing and to avoid toxicity problems when fed to animals.

Table 1: Ingredients Composition of Supplements fed to Yankasa Rams in theExperiment

Ingredients (g)	Supplements					
	1	2	3	4	5	6
	CSC	FA	CSC/MO	FA/MO	CSC/WO	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

Ensiling of Urea Treated Crushed Millet Stover

The millet stover was treated with urea solution and kept in an air-tight condition in plastic drums for 21 days and later was air dried under sun and shade for 7 days.

Experimental Design
The design of the experiment is a Completely Randomized Design (CRD) with six (6) treatment combination diets of five (5) rams each as a replicate.

Experimental Animals and Management
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 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 has been 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 for two 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. The rams were kept for two (2) weeks, adaptation period prior to the commencement of the experiments. Groundnut haulms and maize offal were offered to the rams during the quarantine period.

Chemical Analysis of the Feed Samples
All samples of the **feeds** were analysed for dry matter (DM), organic matter (OM), ash, nitrogen (N), according to the procedures of AOAC (2000). Crude protein (CP) was calculated as N*6.25. Fibre fractions neutral detergent fibre (NDF) and acid detergent fibre (ADF) were analysed using the procedure of Van Soest *et al.* (1991).

Biochemical Analysis
Before and after feeding the experimental diets, at the last week of the experiment, 5mls of blood samples were collected via jugular veins of the experimental animals into cleaned and well labeled sample bottles that did not contain an anticoagulant. The blood collected in these bottles were allowed to clot, retract and the sera harvested was kept frozen at -20^{o}C for biochemical analysis. The biochemical parameters evaluated include sodium ions and potassium ion using ion selective electrode. Bilirubin (total and conjugated) by Jendrassik and Grof Method (1938). Glucose was determined by oxidase method of Braham and Trinder (1972). Albumin concentration was determined by the method described by Doumas, Watson and Biggs (1977). Glutamic Oxaloacetic Transaminase (GOT) and Glutamic Pyruvic Transaminase were determined according to kinetic method of (Sampson *etal*., 1980). The serum enzymes Aspertate, Aminotransaminase, and Alanine Aminotransaminase (ALT) and Alkaline Phosphatase (ALP) were determined using photoelectric calorimeter as described by Duncan *et al*. (1994). Plasma protein was determined according to the method described by other workers (Uko, Ataja and Tanko, 2000). Urea, Nitrogen and Creatinine levels were determined as described by Baker (2000).

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) of the same statistical package.

III. Results

Chemical Composition of Urea Treated and Ensiled Millet Stover Based Diets fed to Rams in the Experiment
Chemical composition of urea treated and ensiled millet stover based diets with supplements fed to rams is presented in Table 14. 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 : Chemical Composition of Supplements and Basal Diets Fed to the Rams in 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

Serum Biochemical Parameters of Yankasa Rams Fed Urea Treated and Ensiled Millet Stover with Supplements

The result of serum biochemical parameters of Yankasa rams fed urea treated and ensiled millet stover based diets with supplements is shown in Table 20. Sodium ion (Na^+) concentration in this study were significantly ($p<0.05$) different before feeding with the highest value of 145.33 (mmol) for T4, T2 had 143.33, followed by T5 and T6 with with 142.00 mmol each. The least value was obtained in T3 139.67 mmol (BF). The values were also significantly ($p<0.05$) different after feeding with the values ranging between 146.00 – 150.00mmol. There was significant ($p<0.05$) difference observed for potassium ion concentration, which ranged from (4.93 – 5.57 mmol) BF and (5.00 – 5.70 mmol) AF.

Blood urea values in this study were significantly ($p<0.05$) different BF, with the highest values of 6.27 for T6 and 4.67 mmol for T2 and T5 respectively. Significant ($p<0.05$) difference was observed also, AF, with values ranging from 6.00 – 8.40 mmol in T3 and T5 respectively. Similarly, there was significant ($p<0.05$) difference for creatinine which ranged between 74.33 – 91.67mmol. Additionally, significant ($p<0.05$) difference was observed (71.50 – 99.00 mmol) AF. AST values in this study were significantly ($p<0.05$) different among diets, the values ranged from (8.67 – 11.67) BF.

Significant ($p<0.05$) difference was observed among the diets AF, with values ranging from 19.00 – 27.00 AF, respectively. Also, ALT values were significantly ($p<0.05$) different and the values ranged from 4.00 – 6.00 BF. Similarly, there was significant ($p<0.05$) difference AF, and the values ranged from 21.00 – 30.00 respectively. Alkaline phosphate values were significantly ($p<0.05$) different BF and AF, the values obtained were 56.33 – 79.33 BF and 38.00 – 150.50 AF, respectively. There was a significant ($p<0.05$) difference in total bilirubin values which ranged from 1.05 – 1.72 (BF) and 0.20 – 5.60 (AF) respectively. However, conjugated or direct bilirubin recorded no significant ($p>0.05$) difference among treatment groups BF and the values ranged from 0.12 to 0.35; a significant ($p<0.05$) difference was observed AF which ranged from 0.04 – 2.50 mmol. Mean values for total protein recorded a significant ($p<0.05$) difference; the values ranged from (66.67 – 70.00g/dl) BF and 61.50 – 69.00g/dl AF respectively.

Table 20 Serum Biochemical Parameters of Yankasa Rams Fed Urea Treated and Ensiled Millet Stover with Supplements

Parameters	Periods	Diets						SEM	LS
		T1 CSC	T2 FA	T3 CSC/MO	T4 FA/MO	T5 CSC/ WO	T6 FA /WO		
Na^+	Before Feeding	141.33^{ab}	143.33^{ab}	139.67^{b}	145.33^{a}	142.00^{ab}	142.00^{ab}	1.50	*
Mmol	4hrs After Feeding	148.00^{a}	149.50^{a}	146.00^{a}	149.00^{a}	150.00^{a}	149.00^{a}	1.30	*
K^+	Before Feeding	5.17^{a}	5.17^{a}	4.93^{a}	5.27^{a}	5.57^{a}	5.03^{a}	0.40	*
Mmol	4hrs After Feeding	5.60^{a}	5.00^{a}	5.30^{a}	5.20^{a}	5.40^{a}	5.70^{a}	0.30	*
Urea	Before Feeding	3.20^{b}	4.67^{ab}	4.63^{ab}	4.30^{b}	4.67^{ab}	6.27^{a}	0.54	*
Mmol	4hrs After Feeding	7.40^{a}	8.01^{a}	6.00^{a}	6.10^{a}	8.40^{a}	7.60^{a}	1.41	*
Creat	Before Feeding	74.33^{a}	79.67^{a}	79.33^{a}	81.33^{a}	78.33^{a}	91.67^{a}	8.94	*
Mmol	4hrs After Feeding	84.50^{a}	96.50^{a}	88.50^{a}	71.50^{a}	99.00^{a}	90.00^{a}	14.03	*
AST	Before Feeding	10.33^{a}	11.67^{a}	9.33^{a}	11.67^{a}	11.00^{a}	8.67^{a}	1.96	*
	4hrs After Feeding	23.50^{a}	25.00^{a}	21.00^{a}	24.00^{a}	19.00^{a}	27.00^{a}	4.34	*

ALT	Before Feeding	6.00[a]	5.67[a]	4.67[a]	6.00[a]	5.67[a]	4.00[a]	1.43	*
	4hrs After Feeding	27.00[a]	26.50[a]	25.00[a]	28.50[a]	21.00[a]	30.00[a]	4.10	*
ALP	Before Feeding	72.67[a]	56.33[a]	63.67[a]	79.33[a]	56.33[a]	56.67[a]	8.27	*
	4hrs After Feeding	150.50[a]	38.00[c]	117.00[ab]	70.50[bc]	113.00[ab]	143.50[a]	13.55	*
TBL	Before Feeding	1.36[a]	1.20[a]	1.37[a]	1.35[a]	1.72[a]	1.05[a]	0.23	*
Mmol	4hrs After Feeding	0.20[a]	0.20[a]	0.20[a]	0.50[a]	5.60[a]	4.95[a]	1.90	*
CBL	Before Feeding	0.28[a]	0.18[a]	0.25[a]	0.26[a]	0.35[a]	0.12[a]	0.82	NS
Mmol	4hrs After Feeding	0.04[b]	0.06[b]	0.04[b]	0.12[b]	1.70[ab]	2.50[a]	0.60	*
TPR	Before Feeding	67.67[a]	69.00[a]	66.67[a]	70.00[a]	68.33[a]	68.33[a]	2.35	*
	4hrs After Feeding	67.00[a]	64.50[a]	61.50[a]	66.50[a]	69.00[a]	66.00[a]	4.60	*

Na^+= Sodium ion; K^+= Potassium ion; Cl^- = Chloride ion; AST = Aspertate amino transferase; ALT = Alanine amino transferase; ALP = Alanine phosphate; TBLRN = Total bilirubin; CBLRN = Conjugated bilirubin; TPRTN = Total protein; ALB = Albumin; T1 = Cotton Seed Cake alone; T2 = *Faidherbia albida* meal alone; T3 = Cotton Seed Cake + Maize Offal; T4 = Gawo Meal + Maize Offal; T5 = Cotton Seed Cake + Wheat Offal; T6 = *Faidherbia albida* meal + Wheat Offal;LSEM = Standard Error of Means; LS = Level of Significance

IV. Discussion

Chemical Composition of the Experimental Diets

The crude protein content of the basal diet, i.e urea treated millet stover in this study was higher than the values reported by Sabo (2012) who reported CP ranges of 9.6- 11.7 % for ensiled maiwa millet with tropical legumes, 11.50% CP in natural pasture grass (Bogoro *et al.,* 2006; Nourou, 2010; Abebe, 2015) and also the content of 7-7.5% required to satisfy ruminal microbial demands for nitrogen that would provide enough CP for the maintenance requirement of the rams.

The NDF values reported in this study are comparable to the 41% as the recommended value that favours the growth of cellulolytic microbes, which increase salivation through eating and rumination (Jane, 2008). The ADF values obtained in this study (21.31 %) were below the range of 38 – 42% ADF recommended for all ruminants as reported by Ranjhan (2001). The possible reasons for differences in values of chemical composition in this study when compared with previous studies might be due to soil fertility and post-harvest managerment as reported by Alhassan *et al,* (1987) that crop residues when allowed to stay in the field long after harvesting the primary produce, there is a decline in their nutritive value. Also, these differences may be due to method of accessing, stage of growth and method of processing the plant.

For the supplemental diets, the dry matter, organic matter, crude protein fibre fractions NDF, and ADF vary across the diets. The variations in nutrient content of each feedstuff could be an indication of relative bioavailability in the feedstuff. Any supplemental diet containing *Faidherbia albida* meal, cotton seed cake, wheat offal, maize offal and urea treated millet stover may be considered as having adequate protein for small ruminants (NRC, 1985).

Effects of Feeding Urea Treated and Ensiled Millet Stover Based Diets with Supplements on Serum Biochemical Parameters of Yankasa Rams

The highest significant values of Sodium concentration were recorded for rams fed D4, D2 and D3 BF and D5 AF respectively, followed by D1. These values were lower than values of 151.00 – 171.50mm BF and 170.00 – 180.00mmol AF (Girgri, 2017). However, the values were within the range 139 – 152mmol reported by (Merck Manual, 2016), 142 – 160mmol (Plumb, 1999) and 143.33 – 151.33mmol (Aruwayo *et al.,* 2011) for different breeds of sheep fed different feedstuff. The variations recorded in this study and the values of other studies may have resulted from variation of intake of sodium in the different feeds based on the content of the experimntal diets.

Potassium (K^+) in this study BF and AF were similar. These values followed the same pattern as in the case of sodium, in that, they were similar to 4.3 – 6.3mmol reported by Plumb (1999) and similar to 3.9 – 5.4mmol reported by Merck Manual (2016). This variation might be associated with different feeds used for different breeds of sheep, which might contain different mineral constituent levels.

Total protein obtained in this study ranged from 66.67 – 70.00g/dl BF and 64.50 – 69.00g/dl AF respectively. These are within the same range of 73.00g/dl for Yankasa rams by Njidda *et al.* (2014). These values were significantly higher than 5.0 – 12.3g/dl by Jawasreh *et al.* (2010), 6.23 – 6.38g/dl by Aruwayo *et al.* (2011), 5.38 – 6.70g/dl by Abdel Ghani *et al.* (2011), 6.3 – 7.2g/dl by Bello and Tsado (2013) and 5.85 6.60g/dl BF and 5.95 -6.55g/dl reported by Girgiri (2017). However, the range of values obtained in the present study were similar to 6.8 – 63.73g/dl reported by Ngele *et al.* (2010). The total protein values in this study were above normal range of 5.7 – 7.8g/dl reported by Plumb (1999). The TP reported from this study was in contradiction to 7.2 – 7.8g/dl obtained by Millam *et al.* (2020), and Daramola *et al.* (2005). This implies that perhaps the rams might have experienced at a time vitamin A deficiency during blood collection after feeding, this agreed with report of Pradhan (2016) that dietary protein has influence on the serum protein which in turn manifest on the total protein value. The high value obtained in this study could be associated with vitamin A

deficiency; the deficiency increased blood albumin levels which in turn increased serum protein (Pradhan, 2016). The increase in serum protein AF may also be as a result of increase gradually with age as reported by (Mbassa & Poulsen, 1991).

Total bilirubin values in this study BF and AF were higher than 0.00 – 0.5mmol normal range for sheep, Plumb (1999), Merck Manual (2016) and 0.00 – 0.3mmol BF and 0.3mmol AF for Yankasa sheep reported by Girgiri (2017). Conjugated or direct bilirubin for this study was in agreement with report of Aruwayo *et al.* (2011) and Girgiri (2017). However, the values obtained in the present study suggested that feeds were capable of releasing adequate nutrients to support basic maintenance and metabolic functions in sheep.

Creatinine values in this study were higher than 1.01 – 1.34 BF and 1.01 – 1.54mg/dl AF reported by Girgiri (2017). They were also higher than 1.21 – 1.44mg/dl by Aruwayo *et al.* (2011) and also beyond the normal range of 1.27mg/dl (Merck manual, 2016) and were higher than 1.11mg/dl reported by Abdel Ghani *et al.* (2011). However, the values obtained in this study were similar to Garba and Abubakar (2012) who reported 75.00 – 100.00mmol/l and Njidda *et al.* (2014) who reported 97.00mmol/l. Elevated levels of creatinine may indicate renal dysfunction.

The blood urea values in this study were lower than 7.75 – 15.30mmol/l reported for Yankasa rams by Girgiri (2017). Similarly, the values were lower than the range of 11.51 – 17.63mmol/l (Ngele *et al.,* 2010). However, the values obtained in this study were closer to 6.00 – 7.80mmol/l by Garba and Abubakar (2012) for Yankasa rams. The values were within the normal range for sheep by Boyd (1984) and Coles (1986).

The Aspertate transaminase values in this study were lower than 47.00g/l for Yankasa rams reported by Njidda *et al.* (2014). The ALT values in this study were within similar range of 22.00UI/L for Yankasa sheep reported by Njidda *et al.* (2014). The Alkaline phosphate values in this study were higher than 55.00UI/L for Yankas rams reported by Njidda *et al.* (2014).

V. Conclusion

It was concluded that ensiled millet with supplements can be fed to growing Yankasa sheep without deleterious effect on biochemical indices. Rams on diet 6 50:50% *FA*:WO performed better in all the haemato-biochemical parameters studied.

Recommendations

Furher studies should be conducted on other ruminans using these feeds.

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