International Journal of Science and Research Archive
eISSN: 2582-8185
Cross Ref DOI: 10.30574/ijsra
Journal homepage: https://ijsra.net/

(RESEARCH ARTICLE)

Check for updates

Hematological and biochemical indices, Rumen pH, Ammonia concentration in rumen liquor and Urine pH of white Fulani (Bunaji) bull Yearling calves fed graded levels of urea and molasses ensiled rice straw supplemented with maize offal and cowpea husk

Adamu B [1,*], Ya`u Adamu Furo [1], A.U Dapellum [1], Surayya A [2] and Usman Abba Muhammed [3]

[1] *Adamawa State Polytechnic, Yola Nigeria.*
[2] *Agric and natural Resources Department. Fufore Local Government Area Adamawa state Nigeria.*
[3] *College for Legal Studies Yola. G.S.T Department Adamawa State Nigeria.*

International Journal of Science and Research Archive, 2024, 11(02), 1874–1884

Publication history: Received on 26 February 2024; revised on 15 April 2024; accepted on 17 April 2024

Article DOI: https://doi.org/10.30574/ijsra.2024.11.2.0597

Abstract

The study was carried out at Duware farm along Yola-Fufore Road Adamawa state. Nigeria to determine the hematological and biochemical indices, rumen pH, ammonia concentration in rumen liquor and urine pH of white Fulani (Bunaji) bull Yearling calves fed graded levels of urea and molasses ensiled rice straw supplemented with maize offal and cowpea husk. Six yearling white Fulani (Bunaji) bull calves weighed 80kg-100kg was used for the research. The treatments diets consist of graded levels of urea and molasses ensiled rice straw supplemented with maize offal in T_1, graded levels of urea and molasses ensiled rice straw supplemented with cowpea husk in T_2, and graded levels of urea and molasses ensiled rice straw only in T_3 (control group). The feeds was offered at 8; 00 am in the morning and 6: 00 pm in the evening, remnants was weight before fresh feeds were offered, mineral lick and water was provided ad-libitum, and animals were weight weekly to determine their growth performance. Two weeks adaptation period was carried out, the experiment last for three months including the adaptation period. Techniques and statistical package for data analysis was completely randomize design (CRD) and the values were subjected to analysis of variance (ANOVA) using least significant difference (LSD) to separate the means. Results revealed that the hematological and biochemical indices PCV, RBC, WBC, HBC, MCV, MCH, MCHC, Total protein, albumin, globulin, creatinine, urea Con. Lymphocytes, Neutrophils, Monocytes were significantly ($P<0.05$) difference across the treatments means, but are not significantly ($P>0.05$) difference among T_2 and T_3 in Eosinophil (%),rumen pH, ammonia concentration in rumen liquor NH3(mg/100ml) and urine pH were not significantly affected ($P>0.05$) by the inclusion level of urea-molasses in an ensiled rice straw in the diets, it can be concluded that the hematological and biochemical indices fall within the recommended values and white Fulani (Bunaji) bull Yearling calves can be fed graded levels of urea and molasses ensiled rice straw supplemented with maize offal and cowpea husk without any deleterious effects.

Keywords: Rice Straw; Urea; Molasses; Maize Offal; Cowpea Husk

1. Introduction

The obstacles in the production and development of livestock industries in Nigeria apart from incidence of disease is that of inadequate and unbalance feeding with regards to energy and protein constituents of the animal diets. The constrained against livestock production in Nigeria and other developing countries are deficiencies of green herbages which are short or erratic in supply particularly marked in areas with long dry season. The Nigeria economy is such that both human and livestock are competing over cereals which are also used as industrial raw materials. (Adamu *et al.,*2021). Opined that the greatest challenges livestock agricultural production faced worldwide are maintaining fodder

* Corresponding author: Adamu B

productivity levels with changing climate and depleting soil fertility, to mitigate these adverse effects of climate and soil fertility, there are need to offer an opportunity to develop a suitable system to improve fodder production for the livestock industry. As it is an apparent fact that the current consumption of animal protein in Nigeria is inadequate, the need aroused therefore to improve the low level of protein consumption particularly animal protein through an intensified effort to provide adequate nutrients and ensure proper feeding to enhance livestock optimum productivity for substantial production, consumption and supply of meat, milk and egg. Adamu *et al.*, (2013). In traditional or conventional methods, crops that are ready to be harvested are often victims of theft by other farmers (herdsmen's) grazing animals or are being stolen. In many instances small scale farmers cannot have access to land that is productive enough for feasible fodder production when using classical agricultural technologies and classical feeds, and the production requires qualified labor to operate machinery or high level of human labor with appropriate stamina (Jeton, 2016).

2. Material and methods

2.1. Study Area

The research was carried out at Duware farm along Yola-Fufore Road Adamawa state. Nigeria, situated within the savannah region and lies between latitude 9^0, 14^1 N and longitude 12^0 21^1 with an altitude of about 152m above sea level. The state has tropical climate with distinct dry and wet seasons. The rainfall begins in April and ends in late October, while the dry season commence in late October or November and ends in April. It has an average minimum and maximum temperature of 18 & 40ºC and relative humidity of 20 and 80%. Adamawa state has an international boundary with the Cameroon Republic along its eastern boarder (Adebayo and Tukur 1999). Adamawa shares boundaries with Taraba State to the south and west, Gombe State to the North-west and Borno State to the north.

2.2. Experimental animals

Six calves aged between 12- 15 months were used, weighing 80 kg-100 kg.The calves were weighed to obtain their initial weight at arrival and treated for both internal and external parasites and subjected to pre-experimental adaptation for two weeks, with three dietary treatments. The feeds was mixed and fed as complete ration daily at 8:00 am and 6:00 pm , housed under a simple shed made of a woods and thatches to prevent harsh weather conditions,

2.3. Experimental design

A completely randomize design (CRD) was used to carried out the research, and the values were subjected to analysis of variance (ANOVA) and means were separated using least significant difference (LSD).

Procurement and Processing of experimental diets

The rice straw was procured from local farmers in Jimeta-Yola in Adamawa state; dried, cut into 10 cm particle size and stored in bags for easy packaging in the silos for ensiling.

- T1. 4kg of urea, 5 kg of molasses ensiled rice straw supplemented with maize offal
- T2. 4kg of urea, 5 kg of molasses ensiled rice straw supplemented with cowpea husk
- T2. 4kg of urea, 5 kg of molasses ensiled rice straw only (control group)

4kg of urea and 5kg of molasses was dissolved in 100 liters of water and 100kg of rice straw was submerged into the solution, pressed and tied in an air tight polythene silos bag for air exclusion, knotted to achieve anaerobic condition for 21 days for better urea hydrolysis as documented by Adamu *et al* (2016) who opined that once the oxygen is exhausted, only anaerobic organism can survive, this allowed the growth of acid forming and photolytic bacteria which convert carbohydrate into lactic acid, protein into ammonia, amines and amino acid which caused decreased pH in the ensiled materials which kills both yeast and mould, acidity continue to increase to a level where the acid producing organisms themselves are killed, at this pH and time ensiling is completed.

2.4. Chemical analysis

The chemical composition of the feed sample was determined in the laboratory; the analysis was conducted to determine Nitrogen (N) for crude protein (CP), crude fibre, ether extract, nitrogen free extract (NFE) and ash content using the proximate analysis (AOAC, 2004) procedure. Acid and neutral detergent fibre was determined according to the procedure described by (Van Soest *et al.,* 1991).

2.5. Data Collection

2.5.1. Hematological and Biochemical indices

Blood samples were collected from the jugular vein of the calves using disposable syringes with needle at the last day (11^{th} weeks) of the feeding trial period. An average of 10mls blood was collected from each calf, blood sample was collected before feeding in the morning, Out of the blood collected, 3mls of each blood sample collected was placed in specimen bottle containing anti-coagulant ethylene diamine tetra acetic acid (EDTA) for haematological analysis as described by (Sirois, 1995). The remaining 7mls of blood was deposited in universal bottle without anticoagulant and allow it to solidify, stand at room temperature and then centrifuge for 15 minutes, the serum separated are preserved in a freezer for chemical analysis as described by (Thomas, 1998). The haematological indices measured include Packed Cell Volume (PCV %), erythrocytes (Red Blood Cell $X10^{-12}$/L), leucocytes (White Blood Cell X 10^{-9}/L), Hemoglobin (Hb) as described by (Jain, 1986). The erythrocytes components that were determined include Mean Corpuscular Volume (MCV), Mean Corpuscular hemoglobin (MCH) and Mean Corpuscular Hemoglobin Concentration (MCHC) as described by (Jain, 1986). The blood serum analyzed for total protein, globulin, albumin, urea, creatinine, lymphocytes and monocytes, eosinophil and neutrophil as described by (Sirois, 1995).

2.5.2. Determination of rumen pH

Determination of rumen pH, a portable pH meter capable of measuring pH from a very small volume of rumen fluid yield very similar results to a standard meter with probe (Garret *et al* 1999). Consequently portable pH meter provide a valuable tool for practitioner wishing to measure rumen pH, Rumen pH was measured immediately after collection by corning electronic meter.

2.5.3. Determination of ammonia concentration in rumen liquor

Determination of rumen ammonia concentration The NH3 – N Concentration of rumen fluid was determined by Dirch distillation and titration by automatic N analyzer (Tecator Kjelder 1030).

2.5.4. Determination of urine pH

The urine was collected with the aid of a slanted groove attached to the cages which allowed the urine to flow into a plastic container, the volume was measured using a graduated laboratory cylinder, urine was collected into a bottle acidified with 10ml concentrated sulphuric acid and store in a refrigerator at 40C for ammonia concentration in urine and urine pH analysis.

2.6. Statistical Analysis

The data generated from the feeding trial was subjected to Statistical Analysis of Variance (ANOVA) using (SPSS, 2009) version 15 statistical package in a Completely Randomized Design (CRD) and where the significance differences exist between the means were separated using Least Significant Difference (LSD) as outline by (Steel and Torrie, 1980).

3. Results and Discussion

Table 1 Gross and calculated chemical composition of experimental treated (ensiled) and untreated rice straw (%DM basis)

Nutrients	DM	CP	CF	EE	Ash	NFE	NDF	ADF	MO	OM	Cel	Hem	Lig	Ca	P
Rice straw	92.40	9.0	10.0	2.1	1.2	68.70	11.38	3.47	4.93	93.50	3.33	7.91	0.14	0.45	0.43
Ensiled rice straw	98.5	12.2	4.0	2.4	10.0	80.4	29.11	13.53	18.20	79.36	12.98	15.58	0.55	0.51	0.47

KEY; , Dry mater (DM) Crude protein (CP), Crude fibre (CF), Ether extract (EE), ,Ash, Nitrogen free extract (NFE), Neutral Detergent Fibre (NDF), Acid Detergent Fibre (ADF), Moisture (MO), Organic Matter (OM), Cellulose (Cel), , Hemi cellulose (Hem) and Lignin (Lig). Metabolizable Energy = ME (Kcal/kg) = (37 x %CP + 81.1 x %EE + 35.5 x %N.F.E NFE = 100 – (%MO + %EE + % CP + % CF%+ ASH). Organic Matter (OM) = Dry mater (DM) – Total Ash (TA). Metabolizable energy (Kcal/kg) 2,998.37

Table 2 Gross and calculated chemical composition of experimental maize offal (% DM basis)

Nutrients	MO	DM	CP	EE	CF	Ash	OM	NFE	ADF	NDF	Cel	Hem	Lig
Maize offal	3.50	86.10	10.52	1.30	10.85	4.00	81.00	55.51	20.45	20.35	5.12	2.5	1.85

KEY; , Moisture (MO), Dry mater (DM) Crude protein (CP), Ether extract (EE), Crude fibre (CF),Ash, Organic Matter (OM), Nitrogen free extract (NFE), Acid Detergent Fibre (ADF), Neutral Detergent Fibre (NDF), Cellulose (Cel), , Hemi cellulose (Hem) and Lignin (Lig). Metabolizable Energy = ME (Kcal/kg) = (37 x %CP + 81.1 x %EE + 35.5 x %N.F.E NFE = 100 – (%MO + %EE + % CP + % CF%+ ASH). Organic Matter (OM) = Dry mater (DM) – Total Ash (TA). Metabolizable energy (Kcal/kg) 2,998.37

Table 3 Gross and calculated chemical composition of experimental cowpea husks (% DM basis)

Nutrients (%)	**DM**	**CP**	**CF**	**EE**	**Ash**	**NFE**	**NDF**	**ADF**
Cowpea Husk	88.50	3.5	9.0	1.0	1.1	76.0	66.1	39.3

KEY; Dry mater (DM) Crude protein (CP), Crude fibre (CF), Ether Extract (EE), Ash, Nitrogen Free Extract (NFE), Neutral Detergent fiber (NDF), Acid detergent fiber (ADF)

Table 4 Effect of feeding urea and molasses ensiled rice straw on haematology and biochemical indices of Yearling white Fulani (Bunaji) bull calves supplemented with energy sources

Parameter	**Treatments**			**Reference Values**	**SEM**	**LSD**
	1	**2**	**3**			
Packed cell volume (%)	35.89^{a}	31.97^{b}	26.95^{d}	24-48	0.03	0.11*
White Blood cell ($x10^{3}$/ µl)	5.95^{d}	7.89^{a}	5.98^{c}	4-12	0.04	0.13*
Red Blood cell ($x10^{6}$/µl)	8.49^{a}	8.38^{b}	7.47^{d}	7-9	0.03	0.11*
Hemoglobin (g/dl)	11.98^{a}	10.68^{b}	8.93^{d}	8-15	0.03	0.11*
MCV (fl)	42.27^{a}	38.15^{b}	36.08^{d}	40-60	0.04	0.13*
MCH (pg/cell)	3.34^{a}	3.34^{b}	3.31^{c}	11-17	0.04	0.12^{ns}
MCHC (g/dl)	33.13^{a}	33.41^{c}	33.14^{b}	30-36	0.03	0.11^{ns}
Biochemical indices						
Total Protein (g/dl)	5.98^{a}	5.05^{b}	4.34^{d}	3-7	0.03	0.11*
Albumin (g/dl)	3.70^{a}	3.60^{ab}	3.00^{c}	2-4	0.03	0.11^{ns}
Globulin (mg/dl)	2.87^{a}	2.54^{b}	1.05^{d}	1-3	0.03	0.09*
Creatinine (mg/dl)	2.79^{a}	1.55^{b}	1.14^{c}	1-3	0.04	0.12^{ns}
Urea Con. (mm/l)	3.95^{a}	3.57^{b}	2.91^{d}	2-4	0.04	0.12*
Eosinophil (%)	3.19^{a}	3.16^{b}	2.16^{b}	0-4	0.03	0.10*
Lymphocytes (%)	64.89^{a}	62.89^{b}	57.97^{d}	40-70	0.04	0.14*
Monocyte (%)	3.99^{a}	3.96^{b}	2.74^{d}	1-6	0.04	0.12*
Neutrophil (%)	29.89^{a}	34.97^{b}	21.87^{d}	22-45	0.04	0.13*

Mean on the same row bearing different superscripts were significant ($P<0.05$)*,SEM=Standard error mean, PCV=packed cell volume, RBC=Red blood cell, MCV = Mean corpuscular volume, MCH = Mean corpuscular hemoglobin, MCHC=Mean corpuscular hemoglobin concentration, WBC=white blood cell, LSD=Least significant different, NS=No significant different.

Effect of feeding urea and molasses ensiled rice straw on haematology and biochemical indices of Yearling white Fulani (Bunaji) bull calves supplemented with energy sources.

3.1. Haematological indices

Table 4. Revealed the effect of feeding urea and molasses ensiled rice straw on haematology indices of Yearling white Fulani (Bunaji) bull calves supplemented with energy sources. The packed cell volume (PCV %) and White blood cell count (WBC) showed significant (P<0.05) difference across the treatments groups. The packed cell volume (PCV %) and white blood cell count (WBC10^3/ µl) ranged from (26.95 to 35.89%) and (5.95to 7.89x10^3/ µl) respectively. The packed cell volume (%) revealed the highest values 35.89% as recorded in T_1, followed by 31.97% recorded in T_2 and the least value 26.95% was recorded in T_3. The white blood cell count (x10^3/ µl) revealed that, the highest values (7.89x 10^3/µl) was recorded in T_2, followed by 5.98 x 10^3/µl in T_3 and the least values was recorded in T_1 with 5.95 x10_3/ µl. The red blood cell count (RBCx10^6/µl) and Hemoglobin (g/dl) showed significant (P<0.05) difference across the treatments means. The red blood cell ranged from (7.47x 10^6/µl to 8.49x10^6/µl) while hemoglobin ranged from (8.93 to 11.98g/dl).

Mean corpuscular volume (MCV), the mean corpuscular hemoglobin (MCH) and Mean corpuscular hemoglobin concentration (MCHC) were significant (P<0.05) different across the treatments means The MCV (fl) ranged from (36.08 to 42.27). The highest MCV (fl) values (42.27 fl) was recorded in T_1, followed by (38.15 fl) in T_2 and the least values (36.08 fl) was recorded in T_3, while MCH (pq) ranged from (3.31 to 3.34 pq)..The highest (MCH) pq/cell values (3.34) was recorded in T_1 and T_2, followed by T_3 with (3.31) pq been the least recorded values. The mean corpuscular heamoglobin concentration (MCHC) was significantly (P<0.05) different across the treatments. The highest value (33.41) g/dl was recorded in T_2, followed by 33.14 in T_3 and the least value of 33.13 was recorded in T_1.

3.2. Biochemical indices

Table 4. showed the effect of feeding urea and molasses ensiled rice straw to Yearling white Fulani (Bunaji) bull calves on biochemical indices supplemented with energy sources The total protein (g/dl)and Globulin (mg/dl) indicated significant (P<0.05) different across the treatments means. The total blood protein ranged from (4.34 to 5.98) g/dl. The highest value of (5.98 mg/dl) was recorded in T_1, followed by T_2 with 5.05 mg/dl and the least value (4.34 mg/dl) was recorded in T_3. Albumin (g/dl) showed no significant (P>0.05) different across the treatments. Recorded highest values (3.70 g/dl) in T_1 followed by T_2 3.60g/dl and the least value (3.00 g/dl) was recorded in T_3. The globulin was significantly (P<0.05) different across the treatments. The highest value of (2.87 mg/dl) was recorded in T_1, followed by (2.54mg/dl) in T_2 and the least value (1.05 mg/dl) was recorded in T_3. The creatinine indicated significant (P<0.05) different across the treatments. The creatinine ranged (2.79 to 1.14 mg/dl), the highest values (2.79mg/dl) were recorded in T_1, followed by T_2 with 1.55 mg/dl and the least value (1.14 mg/d) was recorded in T_3.Urea concentration ranged from (2.91 to 3.95mm/l), the highest value (3.95 mg/dl) was recorded in T_1, followed by (3.57 mg/dl) in T_2 and the least value (2.91 mg/dl) was recorded in T_3.

The Eosinophil, Lymphocyte, Monocyte and Neutrophil showed significant (P<0.05) different across the treatment means. The values ranged from (2.16 to 3.19%), (57.97 to 64.89 %), (2.74 to 3.99 %) and (21.87 to 34.97 %) respectively. Eosinophil recorded the highest value 3.19 % in T_1, followed by 3.16 % in T_2 and the least value 2.16 was recorded in T_3, although there are no significant (P>0.05) different among T_2 and T_3. Lymphocyte recorded the highest value (64.89 %) in T_1, followed by (62.89 %) in T_2 and the least value (57.97 %) was recorded in T_3. Monocyte revealed the highest value (3.99 %) was recorded in T_1, followed by (3.96%) in T_2 and the least values 2.74 % was recorded in T_3 while Neutrophil recorded the highest value (34.97 %) in T_2, followed by 29.89 %) T_1 and the least value 21.87 % was recorded in T_3.

Table 5 Rumen pH, Ammonia concentration in rumen liquor and Urine pH of Yearling white Fulani (Bunaji) bull calves fed (treated) ensiled rice straw supplemented with energy sources (maize offal and cowpea husk)

Parameters	**Treatment**			
	T1	**T2**	**T3**	**LSD**
Rumen pH	6.31	6.30	6.33	0.36**
Rumen NH3(mg/100ml)	0.2360	0.2290	0.3898	0.37*59
Urine Ph	5,51	5.39	5.87	0.33**

Table 5: Rumen pH , Ammonia concentration in rumen liquor and Urine pH of Yearling white Fulani (Bunaji) bull calves fed treated ensiled rice straw supplemented with energy sources (maize offal and cowpea husk)

The rumen pH values revealed 6.31 in T_1, 6.30 T_2 as the lowest values and 6.33 T_3 been the highest values. Rumen NH3 (Ammonia Concentration) the highest rumen ammonia (NH3) concentration was recorded in treatment T_3 (0.3898 mg/100ml) T_2 0.2290 mg/100ml as the lowest and 0.2360 in T_1 while the Urine pH ranged from 5.39 in T_2 as the lowest values recorded, 5,51 in T_1 and 5.87 in T_3 been the highest recorded values .

4. Discussion

4.1. Proximate composition of maize offal

The chemical composition of maize offal is presented in Table 2. The compositional dry mater recorded value (86.10%) of maize offal was consistent with the value of 86.01% as revealed by (Ahmed *et al*., 2001). The dry matter of maize offal was 86.10% lower than the values of 89.21% reported by Ashiru *et al*.(2013. The crude protein (CP) values 10.52%, in this study falls within the values of 9-14% as reported by Aduku, (2005) as the minimum nutrient requirement for small ruminants. The crude protein values obtained were lower than the value of 11.90% reported by Abdullahi *et al*.(2016) who fed urea treated sorghum chaff as a basal diets supplemented with maize offal to Yankasa rams. The crude protein of maize offal (10.52%) reduced significant due to the time / age of maturity as reported by (Shyama *et al*., 2016). The recorded 10.52%) values were lower than the values of 13.6% as reported by (Naik *et al.*, 2014) who fed hydroponic maize to lactating cows. However, increased in crude protein content in treated hydroponic maize might be attributed to the loss in dry matter (DM), particularly carbohydrate, through respiration (oxidation) during germination.

The ether extract (EE) of maize offal (1.30%) was consistent with 1.40% reported by (Abdullahi *et al*., 2016) who fed urea treated sorghum chaff as a basal diets supplemented with maize offal's to Yankasa rams. The crude fibre (CF) content of maize offal was 10.85% and The crude fibre of maize offal recorded by Abdullahi et al.,2016 was 12.85% higher than the values recorded in this study and 11.85% reported by (Alikwe *et al.*, 2012) who fed maize bran, wheat offal and rice bran to West African Dwarf goats.

The nitrogen free extract (NFE) of maize offal recorded was 55.51 lower than the values of 82.12 to 84.15% as reported by (Naik *et al*., 2012); this might be attributed to the increase in the number and size of cell walls for the synthesis of structural carbohydrate, although higher than the values 32.4% as revealed by (Abdullahi *et al*.(2016) who fed urea treated sorghum chaff as a basal diets supplemented with maize offal to Yankasa rams, and also higher than the figure 50.75% reported by (Gabdo *et al*., 2016) who Offered *Leptadenia Hastata* as a Basal Diet. The total Ash values 4.00 maize offal was higher than dry maize seed 1.57% as reported by (Morsy *et al*., 2013).However, the recorded values (4.00) was lower than the figure of 9.36% as reported by (Naik *et al*., 2016). The total ash content was lower than the values of 7.85% as reported by (Ashiru *et al*., 2013). The recorded value of maize offal 4.00% was higher than the value 3.69% as reported by (Babale *et al*., 2018) who fed maize cob replacing maize bran with cowpea husk basal diet to red Sokoto goat. The higher values might be attributed to the increase cell walls for the synthesis of structural carbohydrate.

Table 4 Haemotological and biochemical indices of Yearling white Fulani (Bunaji) bull calves fed ensiled rice straw supplemented with energy sources.

The results of haematological and biochemical indices of yearling white Fulani (Bunaji) bull calves fed ensiled rice straw supplemented with energy sources presented in Table 4. The parameters were significantly ($P<0.05$) difference across the dietary treatment. The packed cell volume (PCV) values ranged from 26.95 to 35.89% which were within the values 28.75 to 36.64%.as obtained by (Abdllahi *et al* 2016) The result falls within the ranged value of (24.12 To 48.01) as reported by (Abasi *et al*., 2014). The PCV value obtained in this study were also within the ranged values 30.16 to 31.42% for healthy calves as reported by (Buhari *et al.,* 2017) who evaluated the breed, sex and age on seasonal changes in hematological variables of tropical goat kids. Normal values of PCV indicated the absence of toxic factors such as haemaglutamin which could have adverse effect on blood formation Oyewole and Ogunkunle (1998).

The white blood cell count values 5.98 to 7.89 $x10^3$/ µl recorded in this study fall within the values revealed by (Abdullahi *et al* 20176) 6.33 to 7.80$x10^3$/ µl . There are significant ($P<0.05$) difference across the treatments means and fall within the range of 6.53 to 8.77$x10^3$/ul reported by Nwachukwu *et al*. (2015) for bull calves fed treated maize cob with urea. Also, the values fall within the range of 8.17 to 11.02 x 10^3 reported by Bello *et al.* (2017) who supplemented forage legume –based concentrate diets to calves. Leucocyte attack destroyed foreign organisms in the body there by defending the body against foreign germs, when it is high it indicates an active infection and a low count may indicate a compromised immune system. Thus, animal with low white blood cell count are exposed to have high risk of disease infection, while those with high white blood cell count are capable of generating antibodies in the process and have high resistance to diseases and enhanced adaptability to local environmental and disease preventive condition (Abasi *et al*., 2014) who evaluated the heamatological parameters and factors affecting their values.

Red blood cell (RBC) count values of 7.47 to 8.49 obtained in this study falls within the standard ranged values of 5.0 to 10.0 x 10^6/ ul reported by (Abasi *et al.,* 2014) The hemoglobin (Hb g/dl) value of 8.93 to 11.98g/dl obtained in this study was significant (P<0.05) difference across the treatments but fall within the values of 12.15 to 12.18mg/dl reported by Jasmine *et al.* (2018) who determine the Haemato-Biochemical parameters in cross bred calves. Hemoglobin is the iron containing oxygen transporting protein in the red blood cells of vertebrate as reported by Oduguwu *et al*. (2012) who fed varying levels of pineapple and cassava peels waste basal diets to West African Dwarf goat. The values also fall within the range of 7.23 to 7.92 g/dl reported by (Obua *et al.*, 2012) who evaluated the hematological profile of West African Goat and Red Sokoto reared in humid southern Nigeria.

The mean corpuscular volume (MCV) showed significant (P<0.05) difference across the treatments. The values 36.08 to 42.27 (fl) recorded in this study fall within the values of 40 to 60 as reported by Abasi *et al.* (2014) who evaluated the heamatological parameters and factors affecting their values. The values also fall within the ranged 38.21 to 38.79 (fl) reported by Jasmine *et al.* (2018) who evaluated the effect of feeding hydroponic maize fodder on the hematology and biochemical parameters in cross bred calves. The mean corpuscular hemoglobin (MCH) and mean corpuscular hemoglobin concentration (MCHC) indicated significant (P<0.05) difference across the treatments. The means corpuscular hemoglobin (MCH) 3.31 to 3.34pg) recorded in this study were lower than the value of 11 to 17 pq reported by Abasi *et al.* (2014) who evaluated the heamatological parameters and factors affecting their values. The values also are lower compared to the range of 6.61 to 6.63pq reported by (Buhari *et al.,* 2017) who evaluated the breed, sex and age on seasonal changes in hematological variables of tropical goat kids. The mean corpuscular hemoglobin concentration (MCHC) obtained in this study 33.13 to 33.41g/dl) fall within the standard values of (31.78 to 32.12)g/dl for calves as reported by Jasmine *et al.* (2018) who evaluated the effect of feeding hydroponic maize fodder on the hematology and biochemical parameters in cross bred calves. The values also fall within the range 33.33 to 33.71 g/dl reported by Ibhaze and Fajemisin, (2017) who determine the blood metabolites of intensively reared West African Dwarf Goat fed pulverized Fibre waste based diet.

Biochemical indices of yearling white Fulani (Bunaji) bull calves fed ensiled rice straw supplemented with energy sources is presented in Table 4. The total blood protein and albumin values were 4.34 to 5.98 (4.64 to 6.53 g/dl and 3.10 to 3.80 (g/ldl) respectively which fall within the normal range (4.19 to 6.74 g/dl and 3.10 to 3.57 g/dl) respectively reported by Ibhaze and Fajemisin, (2017) who determined the blood metabolites of intensively reared West African dwarf goat fed pulverized fibre waste based diet and also agreed with the finding of (Ocheja *et al*., 2014) with 5.77 to 6.77 g/dl and 3.55 to 3.97 g/dl respectively who determined the Performance, Haematological and Serum Biochemical profiles of west African dwarf goat fed diets containing graded levels of cashew nut shell.

Result on globulin, creatinine, eosinophil, lymphocytes, monocytes and neutrophil recorded 1.05 to 2.87 mg/dl, 1.14 to 2.79 mg/dl, 2.16 to 3.19 %, 2.74 to 3.99%, and 21.87 to 34.97% respectively fall within recommended values of 1.71 to 2.78 mg/dl, 0.79 to 0.93 mg/dl, 1.00 to 1.33%, 40 to 70, 3.13 to 3.86 % and 32.90 to 45.65% respectively reported by (Ibhaze and Fajemisin, (2017) who evaluated the blood metabolites of intensively reared gravid West African Dwarf goats fed pulverized bio -fibre wastes based diets. (Belewu and Ogunsola, 2010) who evaluated the hematological and serum Indices of goat fed fungi treated *Jatropha curcas* kernel cake in a mixed ration,(Oni *et al*., 2017) who evaluated the effect of supplementing cassava peels with cassava leaves and cowpea haulms on the rumen environment and blood profile parameters of West African Dwarf Goats. Abasi *et al.* (2014) who conducted a research on haematological parameters and factors affecting their values and Buhari *et al*. (2017) who determine the influence of Breed, Sex and Age on Seasonal Changes in haematological Variables of Tropical Goat Kids respectively. Beside physiological and environmental factors that might affect blood values; age of the animal, housing, feeding, fasting, extreme climatic condition, stress, exercises, transport, castration and disease have been observed as the major factors affecting the performance of the animals

Rumen pH, ammonia concentration in rumen and Urine pH of Yearling white Fulani (Bunaji) bull calves fed ensiled rice straw supplemented with energy sources.

Table 5: Rumen pH (Hydrogen ion Concentration) and Rumen NH3 (Ammonia Concentration) in rumen liquor and urine pH of Yearling white Fulani (Bunaji) bull calves fed ensiled rice straw supplemented with energy sources. Table 5 Revealed that, the rumen pH values 6.31 in T_1, 6.30 T_2 and 6.33 in T_3 respectively was in agreement with the submission of Ahmed *et al.* (2012) who revealed a normal rumen pH value of T_1 (6.32) – T_4 (6.31) and was in agreement with Abdullahi *et al. 2015* who reported similar findings of 6.32 in T_1, 6.30 T_2 and 6.32 in T_3, Ahmed *et al.* (2012) also revealed a normal rumen pH value of T_1 (6.32) – T_3 (6.31) and it compared favorably to the recommended 4% urea required for the optimum rumen microbial functioning as reported by Orskov (1995). The values 6.33 to 6.30 recorded were similar to the values 6.49 to 6.24 as reported by Harikrishna *et al*. (2013) who reported a supplementation effect of thermo

tolerant yeast on nutrients utilization and rumen fermentation. The figures were also lower than the values 6.00 to 7.08 revealed by Yildirim *et al.* (2014) who studied on some gastrointestinal tract characteristics of Karayaka ram.

The values T_1 (6.32), T_2 (6.30), T_3 (6.33) recorded were within the values recorded in this study, but higher values of T_1 (4.63), T_2 (3.89) and T_3 (3.76) as revealed by Inyang *et al.* (2012) who fed cassava peels ensiled with hydrocyanic acid. However, the Rumen Ammonia (NH3) Concentration recorded in these treatments values falls within the recommended range 15-20mg/100ml reported by Leng and Nolan (1984) and this indicate that the concentration of Ammonia (NH3) is sufficient for the digestion of fibrous feeds and this might be attributed to the nature and quantity of the diets the calves were offered and consumed. According to Lindela *et al*. (2013) who opined that the normal rumen ammonia concentration 12-15mg/100ml is the minimum requirements for maximize microbial synthesis, and then 15mg/100ml rumen ammonia concentration is ideal for maximum fiber digestion and 20mg /100ml for maximum intake. The levels of ammonia in the rumen liquor reflect levels of dietary crude protein, but are subject to extreme diurnal fluctuations. Chanjula *et al.* (2004) obtained (0.2357) and (0.3425) when the author fed roughages and supplemented with cassava and sweet potatoes hay to Yankasa rams.

The figures were also lower than the values 6.00 to 7.08 revealed by Yildirim *et al.* (2014) who studied on some gastrointestinal tract characteristics of Karayaka Ram. The values T_1 (6.31), T_2 (6.30), T_3 and (6.33) recorded were higher than the values T_1 (4.63), T_2 (3.89) and T_3 (3.76) revealed by Inyang *et al.* (2012) who fed cassava peels ensiled with hydrocyanic acid and also higher than the values T_1 (3.66), T_2 (3.17) and T_3 (4.29) as opined by Oni *et al*. (2012) who fed sweet orange (*Citrus sinensis*) peel meal substitute with *Cajanus cajan* Hay.

Rumen NH3 (Ammonia Concentration) of Yearling white Fulani bull calves fed ensiled rice straw supplemented with energy sources, the highest Rumen Ammonia (NH3) Concentration was recorded in treatment T_3 0.3898 mg/100ml) and this value falls within the recommended range 15-20mg/100ml reported by Leng and Nolan (1984) and this indicate that the concentration of Ammonia (NH3) is sufficient for the digestion of fibrous feeds. However, the Rumen Ammonia (NH3) Concentration recorded in treatments T_2 0.2290 mg/100ml) is not in agreement with the report of Leng and Nolan (1984), this might be attributed to the nature and quantity of the diets the rams were offered. According to Lindela *et al*. (2013) reported that the normal rumen Ammonia concentration 12-15mg/100ml is the minimum requirements for maximize microbial synthesis. Then 15mg/100ml rumen ammonia concentration is ideal for maximum fiber digestion and 20mg /100ml for maximum intake. The levels of ammonia in the rumen liquor reflect levels of dietary crude protein, but are subjected to extreme diurnal fluctuations. Rumen NH3 concentration nitrogen in this study is lower than the value T_1 (18.0) and T_2 (27.3) as reported by Chanjula *et al.* (2004) who obtained T_1 (0.2357) and T_2 (0.3425) when the author fed roughages and supplemented with cassava and sweet potatoes hay to Yankasa rams.

Urine pH of Yearling white Fulani bull calves fed ensiled rice straw supplemented with energy sources, the highest urine pH was 5.39 to 5.87 in this study, which coincide with the submission of (Constable *et al* ,.2019) of urine pH < 6.22 and < 6.11, based on achieving urine [Ca] ≥5 mmol/L and estimated urinary Ca excretion ≥4 g/d, clinically useful estimate of urine [Ca], but lower than the values recorded urine pH mean in dairy cows of 8.10, ranging from 7.27-8.71, and in beef cows was 7.73, ranging from 7.42 to 8.12 as reported by (Shinichi *et al* 2011)

5. Conclusion

4kg urea and 5kg molasses ensiled rice straw inclusion levels improve the nutritive value of rice straw when offered with maize offal gave high dry matter intake, digestibility and live weight gain. Farmers will have the knowledge of improving lignified rice straw and other fibrous crop residues/by-products and availed them with an improved nutritional feed which reduced feed cost and increase livestock productivity during the dry season when there is constant seasonality fluctuation of herbage in both quality and quantity which result in marked seasonal animal growth and productivity otherwise known as stair case growth. Other studies should be carried out to find the deleterious inclusion levels of urea and molasses in cattle feeds.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of ethical approval

Humane consideration for the well-being of the animal were incorporated into the design and conduct of all procedures involved, and as far as is reasonably practicable, there are no alternative to the use of animals are possible, number of animals used were minimized, unnecessary duplication was avoided, and that procedures and husbandry are refined.

References

[1] A. A.Adabayo, A. L. Tukur: Adamawa State in map journal of applied science and management published by Parakeet, Yola. Nigeria Ltd, Pp.21-26,(1999).

[2] A.O.A.C. (2004).Association of Official Methods of Analysis, 17th ed. Association of Official Analytical Chemists, Washington, D.C

[3] Abasi, N.E., Mary, E.M., Uduak, A. and Edem, E.A.O. (2014).Hematological parameters and factors affecting their value.*Sciences and Education Centre of North America,* 2, Issue, 37 – 47

[4] Abdullahi, S. Nyako H. D. Gabdo I. I. and Adamu, B (2015) Effect of Rumen pH and Rumen Ammonia Fed Urea Treated Sorghum Chaff as a Basal Diet Supplemented with different Levels of Maize Offal on the Performance of Yankasa Rams. Journal of Agricultural Economics, Environment and Social Sciences 1(2):158 –166 December, 2015 Copy Right © 2015. Department of Agricultural Economics, University of Maiduguri, Nigeria Available on line: http://www.unimaid.edu.ng/jaeess ISSN: 2476 – 8423

[5] Abdullahi, S., Nyako, H.D., Malgwi, I.H., Yahya, M.M., Mohammed, I.D., Tijjani, I., Aminu, I.M., and Shehu, I.I. (2016). Performance of Yankasa rams fed urea treated sorghum chaff as a basal diets supplemented with maize offals in semi-arid Environment of Nigeria. *International Journal of Life Science Research,*4(1):15212

[6] Adamu, B. , S. Saidu, S. G. and Yustus Sunday Francis. (2021). Effects of environment on growing hydroponic maize fodder using low-cost greenhouse cultivating unit for livestock production. International Journal of Scientific Research. Vol.10. Issue 05. ISSN.2277-8179. DOI; 10;36;106/ IJSR.

[7] Adamu, B., Abdullahi, S, Abdullahi. M & Elkana, R. .Effect of Urine pH, Hematological Indices, Rumen pH, Rumen NH3 on the Growth Performance of *Yankasa*Ram", Journal of Agricultural Economics, Environment and Social Sciences (JAEESS),Departmentof AgriculturalEconomicsUniversity of Maiduguri, Nigeria Email:jaeess@unimaid.edu.ngWebsite:http://www:unimaid.edu.ng/jaeess

[8] Adamu. B, , S. , M. Elkana, (2016), R. Effect of urine pH, hematological indices, rumen NH_3, on the growth performance of Yankasa rams fed urea and molasses treated maize cobs, Journal of Agricultural Economics, Environment and Social Sciences2(1): 144-152.

[9] Aduku, A. O. (2005) Tropical Feedstuff Analysis Table. Department of Animal Science, Faculty of Agriculture, Ahmadu Bello University Zaria. Nigeria.

[10] Ahmed , S., Khan, M.J., Shahjalal, M., and Islam, K.M (2001). Effect of feeding urea and soya bean meal –treated rice straw on digestibility of feed Nutrients and Growth performances of Bull calves.*International Journal of Science, Innovation and Research,*27: 522-527.

[11] Alikwe, P.C.N., Lamido, A.A. and Aina, A.B.J. (2012). Comparative digestibility and Nitrogen Balance of maize bran, wheat offal and rice bran in West African Dwarf goats,*Journal of Agriculture and Social Research* (JASR), Vol.12, No.1Pp 3-6

[12] Ashiru, R. M. Maigandi, S.A., Muhammed, I.R., and Ibrahim,S.M., (2013). Nutritional Quality Enhancement of Sugarcane Waste Ensiled with Soya beans meals (SBMR). *Proceeding of the 18th Annual Conference 8-12 September, 2013, Abuja, 401-415*

[13] Babale, D.M. Yahaya, M.S., Nyako H.D and Mbahi T.F. (2018). Nutrients Utilization and Haematological Indices of Sokoto Red Goats Fed Maize Cob Replacing Maize Bran with Cowpea Husk Basal Diet.*Journal of Advancements in Plant Science,*1: 103.

[14] Belewu, M.A., and Ogunsola, F.O. (2010). Haematological and Serum Indices of goat fed fungi treated *Jatropha curcas* kernel cake in a mixed ration.*Journal of Agricultural Biotechnology and sustainable development,* 2(3):035-038.

[15] Bello, R.A., Fasae, O.A., Oluwatosin, B.O., and Olanite, J.A. (2017) Response of calves to supplementation of forage legume based concentrate Diets.*Pertanika Journal of Tropical Agricultural science,*40(3): 377 – 388.

[16] Buhari, H., Mohammed, K., Hussaina, M., Tagag, A., Lukman, Y., Tavershima, D., and Harajarh, B. (2017). Influence of Breed, Sex and Age on Seasonal Changes Variationhaematological Variables of Tropical Goat Kids. *Journal of Animal Breed,*5(60): 33 – 42.

[17] Chanjula, PM., Wanapat, C., Wachirapakorn and Rowlinson, (2004). Effect of synchronizing starch sources and protein (NPN) in the rumen on feed intake, rumen microbial fermentation, nutrient utilization and performance of lactating dairy cows *. Asian –Australasian Journal of Animal Science* 17:1400-1410.

[18] Constable, P.D A. A Megahed , M.W.H. Hiew (2019) Measurement of urine pH and net acid excretion and their association with urine calcium excretion in periparturient dairy cows. Dairy Science 2019 doi: 10.3168/jds.2019-16805. Epub 2019 Sep 20. Dec; 102(12):11370-11383. National center for biotechnology information National library of medicine

[19] Gabdo, I.I., Nyako, H.D., , S., Wafar, R.J. (2016). Effect of supplementation of maize offal on the performance of Yankasa rams offered *Leptadenia hastata* as a basal diets. *British Journal of Applied Research,*1(1): 27-29

[20] Garret E.F, Perereira M.N. (1999). Diagnostic method for detection of sub-acute Ruminal Acidosis in Dairy Cows. *Journal of dairy science* 82:1170-1178. Gomez, K.A and Gomez, A.A (1984). Statistical procedure for Agricultural Research 2nd Ed.

[21] Harikrishna, CH.,Mahender, M., Ramana Reddy, Y., Gana, M., Prakash, Y., Sudhakar, K., and Pavani, M. (2013). Supplementation Effect of thermo tolerant yeast on nutrients utilization and Rumen Fermentation in Nellore Lambs. *Livestock Research for Rural Developments* 25(5), 2013.

[22] Ibhaze, G.A., and Fajemisin, A.N., (2017). Blood Metabolites of Intensively Reared Gravid West African Dwarf Goats fed pulverized bio-fibre wastes based diets. *Animal Research International,*14(1):2598 – 2603.

[23] Inyang Y. Dimas: A.A.Fadiyimu, A.N. Fajemising (2012) Rumen degradation characteristic of some browse plants in Mayo-Belwa L.G.A Adamawa State M. Tech thesis (MAUTECT,YOLA) Pp 43-56, (2012). [8]

[24] Jain, N.C. (1986). Schalms Veterinary Hematology, 4th edition, Lea and Fabiger, Philadelphia, U.S.A

[25] Jasmine, K.R., Ally, K., Shyama, K., and Purushothaman, S. (2018). Nutritional Evaluation and Effect of Feeding hydroponic maize on Haemato-Biochemicalparameters in crossbred calves.*Journal of Veterinary Animal Science,*50(1):57-62

[26] Jeton, S. (2016). Hydroponic fodder production. Livestock Productivity and Marketing Adviser. Malaysia, *Journal of Animal Science* 16 (2) Pp 37 – 44 www.prime-ethiopia.org.3(9):1-5.

[27] Leng, R.A and Nolan, J.V (1984). Nitrogen Metabolism in the rumen J. Dairy Sci. 67: 1072 – 1089.

[28] Lindela, R.N, Yusuf K.O; Isah, O.A; Onwuka, C.F.I; O lanite, J.A; Oni and Aderinboye, R.Y (2013). Effects of enzymes additive on nutrient intake digestibility and rumen metabolites of yearling cattle feed grass-hay based diet. *Nigerian journal of Animal Science. 1*5:155-167.

[29] Morsy, T.R.R., Hunter, S.A., and Haire.(2013). Limiting factors in hydroponic barley grass production. 8th *International congress on soils culture hunters, rest, South Africa.*12:23-44

[30] Naik, P.K., Dhawaskar, B.D., Fatarpekar, D.D., Chakurkar, E.B., Swain, B.K., and Singh,N.P.(2016).Nutrient Changes with Growth of Hydroponic Cowpea (*Vigna unguiculata*) Sprout. *Indian Journal of Animal Nutrition,*33(3): 357-359

[31] Naik, P.K., Dhuri, R.B., Karunakaran, M., Swain, B., and Singh, N.P. (2014).Effect of feeding hydroponics maize fodder on digestibility, nutrients and milk production in lactating cows. *Indian Journal of Animal Sciences,*84(4):880-883

[32] Naik, P.K., Dhuri, R.B., Swain, B.K., and Singh, N.P.(2012). Nutrients Changes with theofhydroponic maize fodder.*Indian Journal of Animal Nutrition,* 29(2): 161-163

[33] Nwachukwu, E.N., Ogbu, C.C., Ahamefule, F.O., and Antia, E.A., (2015). Effect of creep feeding on growth, hematology and serum biochemistry of bull calves.*Global Journal of Animal Breeding and Genetics,* 3(3): 139 – 145.

[34] Obua, B.E., Amaechi, N and Osodeke, S.C. (2012). Comparative evaluation of Haematological profile of West African Dwarf and Red Sokoto Goats reared in Humid Southern Nigeria. *Journal of Agricultural and RuralDevelopment,*15(3):1190 – 1197.

[35] Ocheja, J.O., Alex, B.C., Onoja, S. (2014). Performance, Haematological and Serum Biochemical profiles of West African Dwarf goat fed with diets containing graded levels of cashew nut shell. *International Journal of Research in Agriculture and Forestry*,12:27 – 33.

[36] Oduguwu, B.O., Amole, A.O., Okwehum, N., Shitu, O.O., Ogunlolu, B.T., Olayujin, S.A., Olafinsanimi, T., Adesunmbola. O.J., Sanusi, G.O., Bello, K.O., and Oguguwa, O.O., (2012). Performance and Blood Chemistry of West African Dwarf goat fed varying levels of pineapple and Cassava Peels Waste Basal diets. *Proceeding of the 17thAnnual Conference of Animal Science Association of Nigeria* (ASAN) held at Abuja, 9th – 13th September, 2012: 607 – 609.

[37] Oni, A.O., Arigbede, O.M., Sowande , O.S., Oni, U.Y., Areegbe, A.O., Aderinboye, R.Y., Yusuf, K.O., and Owuka, C.F.I., (2012).Effect Addition of Molasses and Cage.

[38] Orskov, E.R. and McDonald, I. (1979). The evaluation of protein degradability from incubation measurement weighted according to rates of passage. *Journal of Agricultural Science,* 92:499-503.

[39] Orskov, E.R., Kay M. and Reid G.W. (1995) Prediction of intake of straw and performance by cattle from chemical analysis, biological measurement and degradation characteristics. In: chenost, M. and Reiniger P. (eds). Evaluation of straw in ruminant feeding *Elsevier science publishing,* Co. Inc. Pp 155-162.

[40] Oyewole, E.O and Ogunkunle, M.(1998). Chemical Analysis and BiochemicalEffect of Raw Jacck Beans on Broiler, Procedings of the Nigerian Society of Animal Production, 23:141-142.

[41] Shinichi Kume, Tomoe Sato, Iori Murai, Masayuki Kitagawa, Kazuhisa Nonaka, Tomoko Oshita (2011) Relationships between urine pH and electrolyte status in cows fed forages. Animal Science Journal © 2011 Japanese Society of Animal Science 2011 Jun;82 (3):456-60. doi: 10.1111/j.1740-0929.2010.00853.x. Epub 2011 Mar 6. National center for biotechnology information National library of medicine

[42] Shyama, K., Rajkumar, G., Jasmine Rani, K., and Thirpathy Venkatachalapathy, R. (2016).Effect of feeding of hydroponic fodder maize as partial protein supplement on growth performance in kids.*Journal of Indian Veterinary Association,*14(3):32 – 26

[43] Sirois M. (1995).Veterinary clinical laboratory procedure.Mosby St Louis, USA Pp 160.

[44] SPSS. (2009). Statistical Package for Social Science Version 15

[45] Steel, R.G.D., and Torrie, J.H. (1980). Principles and procedures of statistics, M.C Grow Hill book company INC. New York.

[46] Thomas L. (1998) Clinical Laboratory diagnostics 1sted Frankfurt: TH books vertices elicit,

[47] Van Soest, P.J., Robertson, J.B., and Lewis, B.A. (1991). Methods for Dietary Fiber, Neutral detergent fiber and non-starch polysaccharides in relation to animal nutrition, *Journal of Dairy Science,*74 (32): 3579 – 3583.

[48] Yildirim, A., Aksoy, Y., Ocak, N., and Ulutas, Z. (2014). Some Gastrointestinal Tract Characteristics of Karayaka Ram Lambs Slaughtered at Different weight. The *Scientific World Journa*l. Volume 2014 (2014