FUDMA Journal of Sciences (FJS)
ISSN online: 2616-1370
ISSN print: 2645 - 2944
Vol. 6 No. 2, April, 2022, pp 268 - 274
DOI: https://doi.org/10.33003/fjs-2022-0602-1754

NUTRIENT DIGESTIBILITY AND RUMEN METABOLITE PROFILE CONCENTRATION OF GROWING YANKASA RAMS FED *BRACHIARIA* MULATO II BASE TOTAL MIXED RATION AT DIFFERENT PERCENT BODY WEIGHT

***[1]Ahmed S. A, [2]Abdu S. B., [1]Amodu J. T., [1]Hassan, M. R., [1]Ishiaku Y. M., Salisu S. G., Hassan R., and Sani R. T.**

[1]National Animal Production Research Institute, P.M.B 1096, Ahmadu Bello University, Shika, Zaria, Nigeria.
[2]Department of Animal Science, Ahmadu Bello University, Shika, Zaria, Nigeria.

*Corresponding authors' email: safiyanahmed2@gmail.com Phone: +2347069108385

ABSTRACT

Twenty (20) apparently healthy growing Yankasa rams with a mean initial live weight of 20-21kg±0.5kg were used for 120 days feeding and 21 days digestibility trials to was carried out to determine nutrient digestibility and rumen metabolites profile of growing Yankasa rams. The animals were grouped into four with five animals each in a Completely Randomized Design (CRD) and randomly allocated to four treatments. The treatments were 2.5, 3.0, 3.5 and 4.0% body weight. The DM (88.38%), CP (89.70%), NDF (74.54%) and ADF (77.63%) were significantly (P<0.05) higher in animals fed 4% body weight. OM (87.27%) was significantly (P<0.05) higher at 3.0% body weight, but EE (90.14%) was significantly (P<0.05) higher in animals fed 3.5% body weight. Nutrient digestibility showed significant variation (P<0.05) across the treatments. Rumen pH was within the normal range (6.77-6.87). TVFA (Total volatile fatty acid) (24.67 Mmol/100ml) at 0hours was significantly (P<0.05) higher in animals fed 3.5% body weight while Rumen Ammonia nitrogen (NH_4-N) (63mg/lt) at 4 hours of sampling was significantly (P<0.05) higher with animals fed 4% body weight. Therefore, it was concluded that feeding *Brachiaria* Mulato II based total mixed ration at 4% body weight increased Dry matter digestibility by 88.38% and Crude protein digestibility by 89.70% respectively. Livestock farmers are encouraged to feed *Brachiaria* Mulato II based total mixed ration at 60:40 ratio for improved utilization and normal rumen function.

Keywords: *Brachiaria* Mulato II**,** Profile, Digestibility, Yankasa Rams

INTRODUCTION

The major constraint to livestock production in developing countries such as Nigeria is the scarcity and fluctuating quantity and quality of all year-round feed supply. The future hope for feeding the rapidly growing human population will depend on the enhanced and efficient utilization of unconventional resources that cannot be used by humans as feed (Ørskov, 1998:1999). In Nigeria, the major challenge to livestock production is ensuring adequate feed supply throughout the year in terms of quality and quantity (Kallah. *et al.*, 1997). Ruminants are fed mainly on agro-industrial by-products containing a large portion of Ligno-cellulose feeds such as cereal crop residues (straws and stovers) native pastures and other related feeds. These feeds are usually poor in protein energy, minerals and vitamins (Kapu, 1975; Bogoro, 1997). Ruminants in the tropics are raised predominantly on grasses which are inherently poor in digestibility, nutritive value and unavailable in the off-season (Babayemi, 2009).

Brachiaria is a species of grass originating from the savannas of the Eastern part of Africa. The grass species is widely used as livestock feed. *Brachiaria* species are either annual or perennial grasses, with most of the species lacking rhizomes. The inflorescense has panicle branches composed of racemes and the entire plant usually do not grow higher than 1m. *Brachiaria* belongs to the C4 plants which tolerate drier conditions and more light exposure than many other plants (Watson and Dallwitz, 2008). *Brachiaria* is the most important forage grass for pastures in the tropics (Singh, 2009). *Brachiaria* cultivars have impacted the economy of various countries in the tropics because of their ability to grow so well in low fertility acid soils and still able to produce highly nutritious forage for many ruminants. In the past 25-30 years *Brachiaria* cultivation and export has become a major component of sown pastures (Singh, 2009). In South America, Brazil represents the leading user of *Brachiaria* forage. *Brachiaria* grass has a rapid growth especially in the wet season. Its compatibility with *Stylosanthes humilis* and *S. hamata* is highly noted and also its ease of establishment (Miles *et al.*, 1996). *Brachiaria* species combines well with other grasses and legumes. *Brachiaria* hybrid CIAT 36087 a high-quality forage grass resistant to spittlebug and adapted to well-drained acid tropical soil. *Brachiaria* are grasses most commonly found in extensive pasture land of tropical Latin America. There are still areas with acid soil of low fertility and poor drainage or that surfer periodic flooding where the establishment of improved cultivars of the type is slow and their use is limited (Miles *et al., 2004*). These areas are also characterized by adverse topographic and climate condition and high pest and disease incidence with predominance of extensive management system in degraded pasture. In view of the high negative impact of this condition on livestock productivity in the tropic.

Objective of the Study

This study is intended to determine the Nutrient digestibility by Growing Yankasa rams fed *Brachiaria Mulato II* based total mixed ration, and to estimate the Rumen metabolite profile of Growing Yankasa rams fed *Brachiaria Mulato II* based total mixed ration.

MATERIALS AND METHOD

Location of the Study

This Experiment was carried out at the calf house of the Dairy Research Programme (DRP) of the National Animal Production Research Institute (NAPRI), Ahmadu Bello University, Shika-Zaria, 22km North West of Zaria in the Northern Guinea Savannah zone of Nigeria. Shika is geographically located between latitude 11^0 12'N and longitude 7^0 33'E at an altitude of 660m above sea level

(Ovimaps,2015), Wet season starts from April to early May and ends in late September to early October. Long- term annual rainfall ranges from 1110 to 1580 mm with maximum temperature of 30^{O}C and relative humidity of approximately 70% (*I.A.R*, 2017).

Management of Experimental Animals

Twenty (20) apparently healthy Growing Yankasa rams of about one year old and of similar weight (20-25±0.5 kg) were used. The experimental animals were given prophylactic treatment against ecto and endo parasites and were housed in individual stalls. The animals had free access to clean water (*ad-libitum*) and mineral salt lick. Animals were acclimatized with the environment and feed for a period of two weeks before the commencement of the experiment. The feeding regime was 8am in the morning and 2pm afternoon.

Digestibility Trial

At the end of the feeding trial of 120 days, three rams were randomly selected from each group and housed in individual metabolic cages. They were placed on the experimental diets for 7 days adjustment period followed by 7 days collection period for urine and faeces. The daily faecal output per treatment were collected weighed and oven dried at 60 ^{O}C for 6 hours, bulked, 10% sub-sample was collected and stored in polythene bags until ready for analysis according to the procedure outlined by Osuji *et al*., (1999). The total urine output for 24 hours was collected from individual animal for a period of 7 days. This was done by using graduated plastic containers containing 10mls 0.1NH_2SO_4 to prevent nitrogen loss through volatilization. Thereafter, 10% of the total urine collected will be kept in the refrigerator until ready for analysis to determine nitrogen balance as reported by Osuji *et al*. (1993).

Rumen fluid Sampling

Rumen fluid samples were collected from the rams in each treatment at the end of the feeding trial at 0,4 and 6 hours after feeding. About 10mls of the rumen fluids were collected from all the rams in each treatment using stomach tube. The tube which is about 150cm long with a metallic strainer attached to the end was passed through a pipe placed in the mouth of the rams into the rumen and a suction pump was used to draw out rumen fluid to the other end of the tube. The fluid was collected into plastic bottles containing equal quantity of 0.1N H_2SO_4 to trap ammonia. The samples were refrigerated until required for analysis. Rumen ammonia concentration was determined by steam distillation into Boric acid and back titrated with 0.01N hydrochloric acid, according to the procedure described by Whitehead *et al.* (1976). Rumen fluid temperature was recorded immediately using digital thermometer and rumen fluid pH was determined using Philips digital pH meter (Model 9409).

Chemical analysis

The experimental diets and faecal samples were subsampled and taken to the laboratory to determined their proximate composition (Dry matter, Crude Protein, Crude Fiber (CF), Ether Extract (EE) and Ash using the method of AOAC (2000) and Nitrogen Free Extract (NFE) content will be calculated by difference. Neutral detergent fibre (NDF), Acid detergent fibre (ADF), Hemicellulose were determined by method of van-Soest *et al.* (1999). The Metabolizable energy of the diet was estimated using the Alderman (1985) Equation:

ME (MJ/KgDM) = 11.78 + 0.0064 CP + (0.000665EE) ^{2} – CF (0.004EE) - 0.0118A

Statistical Analysis:

All data collected on the animal experiment was subjected to ANOVA using SAS package (SAS, 2002) and the means were separated using Duncan Multiple Rage Test (Duncan,1955).

Statistical Model

$\mathbf{Y_{ij} = \mu_i + I_j + E_{ij}}$

Where:

Y_{ij} = Dependent variable

μ = Population mean

I_J= Effect of Percentage body weight (i = 4, 3.5, 3.0, 2.5% BW).

E_{ij} = Random error.

RESULTS AND DISCUSSION

The composition of the experimental Diet and calculated analysis is presented in table 1. Below

Table 1: Gross composition of experimental diet and calculated analysis

Ingredients	(%) as Dry matter
Mulato II (Hay)	60.00
Maize Bran	17.00
Cotton seed cake	20.00
Bone meal	2.00
Salt	1.00
Total	**100**
CP calculated	14.02
Energy calculated	8,630 kcal/kg
Cost per kg (₦)	62.48

Chemical Composition and Energy Content of *Brachiaria Hybrid* (Mulato II): concentrate TMR.

The chemical composition of the Diet and its energy content is presented in table 2 below. Dry matter content of the diet ranged from 97.94%.the organic matter content ranged from 87.8% while the crude protein content ADF, NDF and total digestible nutrient are 12.99%,35.69%,45.72% and 54.61% respectively.

The chemical composition of the Diet and its energy content is presented in table 15 above, Dry matter content of the diet ranged from 97.94%.the organic matter content ranged from 87.8% while the crude protein content ADF, NDF and total digestible nutrient are 12.99%,35.69%,45.72% and 54.61% respectively. The C.P content of the diet (12.99) is above the minimum requirement for maintenance of a ruminant animal as reported by NRC (2007) and Van Soest (1994) that CP ranges of 6-8% CP is required for efficient rumen function and maintenance.

Table 2: Chemical Composition and Energy Content of Brachiaria Hybrid Mulato II: concentrate TMR

Parameter	Percentage (%).
Dry Matter	97.94
Organic Matter	87.8
Crude Protein	12.99
Ether extract	4.67
Nitrogen free Extract	47.19
Ash	10.14
ADF	35.69
NDF	45.72
Hemicellulose	10.03
TDN	54.61
ME (Kcal/kg)	8,630 kcal/kg

The Nutrient digestibility of *Brachiaria Hybrid Mulato II:* Concentrate TMR fed to growing Yankasa Rams at different percent body weights.

The Nutrient digestibility of *Brachiaria Hybrid Mulato II:* Concentrate TMR fed to growing Yankasa Rams at different percent body weights is presented in table 4. Dry matte digestibility (88.38%) was significantly (P>0.05) higher in rams fed 4% body weight compared to the other treatments. The Organic matter digestibility (89.27%) at 3% and (86.85%) at 4% were at par and significantly (P>0.05) higher than the other treatments. Either extract digestibility was significantly (P>0.05) higher (90.14%) in rams fed 3.5% body weight which is similar to (89.57%) recorded in rams fed 4% body weight. The Neutral detergent fibre and Acid detergent fibre digestibility were significantly (P>0.05) higher in rams fed 4% body weight (74.54% and 77.63%) respectively.

Dry matte digestibility (88.38%) was higher in rams fed 4% body weight compared to the other treatments. The Organic matter digestibility (89.27%) at 3% and (86.85%) at 4% were at par and higher than the other treatments. OMD obtained in this present study is higher than the range (81.40-85.45%) obtained by Ahmed *et al*., (2019) when *Brachiaria ruziziensis* and concentrate total mixed ration was fed to growing yankasa rams. Crude protein digestibility (89.70%) was higher at 4% body weight, Ether extract digestibility was higher (90.14%) in rams fed 3.5% body weight which is similar to (89.57%) recorded in rams fed 4% body weight. The Neutral detergent fibre and Acid detergent fibre digestibility higher in rams fed 4% body weight (74.54% and 77.63%) respectively. FAO, (1995) classified digestibility of feed as high (>60%), medium (40 - 60%) and low (<40%). This is also in agreement with the report of Quala *et al.* (2011) that the activity of ruminant microbes is improved by the presence of nitrogen. The DMD values (88.38%) obtained in the present study is similar to the range 80.57- 84.90 % obtained by Ahmed *et al*., (2019) when the author fed *Brachiaria ruziziensis* and concentrate in a total mixed ration to growing yankasa rams, but is higher than the result obtained by Usman *et al.* (2008) whose value ranged between 61.39% and 84.37% when fore stomach digesta and poultry waste was fed to Uda lambs. Also, the crude protein digestibility (CPD) values range from 89.70% while the least value of 81.72% were obtained, the result of this study was similar to the findings of Fajemisin *et al.* (2012) who reported digestibility values of 84.92 to 86.02%, and higher than the values reported by Maigandi and Wasagu (2002) whose value ranged between 75.5% and 81.06% when *Ficus sycomorus* leaves were fed to Yankasa rams. McDonald *et al.* (2011) reported that digestibility is much reduced when a ration contains little protein in proportion to the amount of readily digestible carbohydrate, also Nsinamwa *et al*. (2005) agreed with the report that the higher the fibre fractions, the lower the digestibility. Giri *et al*., (2000) and Aregheore (2000) affirmed that digestibility of nutrient varies with nutrient composition of diets.

Table 4: Nutrient digestibility of Brachiaria Mulato II base Total mixed ration fed to growing Yankasa Rams at different percent body weights

	Percentage Body weight (%)				
Parameters	2.5	3.0	3.5	4	SEM
Dry matter	74.40^{d}	76.42^{c}	79.36^{b}	88.38a	1.53*
Organic matter	72.90^{c}	87.27^{a}	85.49^{b}	86.85^{a}	1.87*
Crude protein	81.72^{d}	80.25^{c}	86.66^{b}	89.70^{a}	1.27*
Either extract	87.99^{b}	85.84^{c}	90.14^{a}	89.57^{a}	2.44*
Ash	69.74^{b}	68.46^{d}	70.11^{b}	83.37^{a}	3.61*
NDF	51.27^{d}	63.38^{b}	61.63^{c}	74.54^{a}	2,65*
ADF	65.56^{d}	69.99^{b}	67.47^{c}	77.63^{a}	6.30*

$^{a\,b\,c:}$ Means with different superscripts within a row differed significantly (P<0.05). SEM: Standard error of mean, * Significant at 5%,

Nitrogen Balance in Growing Yankasa Rams fed *Brachiaria Mulato II* based total mixed ration (TMR) at different percent body weight.

Nitrogen Balance in growing Yankasa rams fed *Brachiaria Mulato II* based total mixed ration (TMR) at different percent body weight is presented in Table 5. The nitrogen intake was significantly (P<0.05) higher (64.62g) in rams fed at 3.5% body weight which was at par with (63.71g) in rams fed at 4% body weight and the lowest (34.06g) was recorded in rams fed diet at 2% body weight. The faecal nitrogen output (6.52g) was significantly (P<0.05) higher in rams fed at 4% body weight compared to the other treatments. Urinary nitrogen output was significantly (P<0.05) higher (5.04g) in rams fed at 2.5% body weight compared to the other treatments. The nitrogen absorbed (57.79g) in rams fed at 3.5% body weight was significantly (P<0.05) higher but similar to (57.20g)

observed in rams fed at 4% body weight. Nitrogen retain was significantly (P<0.05) higher (57.99g) in rams fed at 3.5% body weight and the lowest value (26.78g) was recorded at 2.5% body weight. The nitrogen retain as percentage of intake was significantly (P<0.05) higher (89.75%) in rams fed at 3.5% body weight compared to all other treatments.

The significant higher nitrogen intake in rams fed at 3.5% and 4% body weight could be expainned by fact that nitrogen helps to provide the fermentable nitrogen for efficient synthesis of essential amino acids and positive nitrogen balance (Trinh *et al*., 2009; Hassan *et al*., 2016). The faecal nitrogen output (6.52g) was higher in rams fed at 4% body weight compared to other treatments. Urinary nitrogen output was higher (5.04g) in rams fed at 2.5% body weight compared to the other treatments. The nitrogen absorbed (57.79g) in rams fed at 3.5% body weight higher but similar to (57.20g) observed in rams fed at 4% body weight. Nitrogen retained was higher (57.99g) in rams fed at 3.5% body weight and the lowest (26.78g) was recorded at 2.5% body weight. The nitrogen retained as percentage of intake was higher (89.75%) in rams fed at 3.5% body weight compared to other treatments. Nitrogen retention is the major indicator for assessing the protein nutritional status of ruminant livestock (Abdu *et al*., 2012; Hassan *et al*., 2016). It is also the proportion of nitrogen utilized by animals from the total nitrogen intake for the body processes, hence the more nitrogen consumed and digested the more nitrogen retained and vice versa (Okeniyi *et al*., 2010). The nitrogen retained and absorbed as percentage of intake were similar to 68.0 % and higher than 47.98 % reported by Yashim *et al*. (2014) who fed *Digitaria smutsii* hay supplemented with *Ficus sycomorus* leaf meal but in line with 95.84 % and 74.24 % reported by Wada *et al*. (2016) who fed total mixed rations containing *Parkia biglobosa* forage included at graded levels.

Table 5: Nitrogen Balance in Growing Yankasa Rams Fed Brachiaria Mulato II based total mixed ration at Different Percent Body Weight

	Percentage body weight (%)				
Parameters	**2.5**	**3.0**	**3.5**	**4**	**SEM**
N intake (g)	34.06^{c}	47.70^{b}	64.62^{a}	63.71^{ab}	5.507*
Feacal N output (g)	2.25^{d}	4.17^{c}	5.10^{b}	6.52^{a}	0.371*
Urinary N output (g)	5.04^{a}	2.98^{b}	1.53^{c}	2.28^{d}	0.319*
Total N outgo (g)	7.28^{d}	7.15^{c}	6.63^{b}	8.79^{a}	0.565*
Nitrogen absorbed (g)	31.82^{d}	43.52^{c}	59.53^{a}	57.20^{a}	5.185*
Nitrogen Retained (g)	26.78^{d}	40.54^{c}	57.99^{a}	54.92^{b}	4.995*
N retained as % of intake	78.52^{c}	84.84^{ab}	89.75^{a}	82.11^{b}	1.229*

$^{a, b, c:}$ Means with different superscript within a row differed significantly (P<0.05). SEM= Standard Error of Means. * Significant at 5%

Interactive effects of feeding *Brachiaria Mulato II* base total mixed ration to growing Yankasa Ram at different percent body weights and hours of sampling on some rumen metabolites

Interactive effects of feeding *Brachiaria mulato II* based TMR to growing Yankasa rams at different hours and percent body weights on some rumen metabolites is presented in Table 6.

At 0hrs of sampling the rumen temperature across the percent body weight ranged between (30.5-31.5 ^{0}C). The rumen pH across the treatments ranged between (6.77-6.87). TVFA (24.67 Mmol/100ml) was significantly higher in rams fed 3% body weight and the lowest (19.67Mmol/100ml) in rams fed 3.5% body weight. The rumen NH_3 N was significantly (P<0.05) higher (60mg/lt) in rams fed 3.5% body weight and the lowest (43mg/lt) was observed at 2.5% body weight.

At 4hrs of sampling, rumen temperature ranged between (30.5-31.5 ^{0}C) across all the percent body weight. The rumen pH ranged between (6.77-6.87) across. TVFA at 3.5% and 3% (23.33 Mmol/100ml) was significantly higher than the other percent body weight. Rumen NH_3 N (63mg/lt) was significantly higher in rams fed 4% body weight than the other treatments.

At 6hrs of sampling rumen temperature were similar across the percent body weights and it ranged between (31.97-32.50 ^{0}C). The rumen pH ranged from (6.57-6.77). TVFA (24.00 Mmol/100ml) was significantly higher in rams fed 2.5% body weight and the lowest (19.33Mmol/100mls) was observed at 3.5% body weight. The Rumen NH_3 N was observed to be significantly (P<0.05) higher (53mg/lt) in rams fed 4% body weight and the lowest (43mg/lt) was recorded in rams fed 3% body weight.

Ahmed (2019) reported a rumen pH range of (6.4- 6.8) similar to the report of Adamu (2015) who reported a normal pH range of (6.2-6.9). The slightly alkaline rumen condition in this study was probably due to increased concentration of ammonia in the rumen. Jokthan (2007) obtained a pH of 7.1-7.31 when pigeon pea forage-based diets were fed to sheep on rice straw basal diets. The pH value obtained in this study fell within the range (6.0-7.0) reported by Osinowo *et al*., (1994). Difference in ruminal pH may also result from variations of VFA concentrations, since ruminal pH reflects the rate of fermentation of carbohydrate (Galip, 2006). This can be attributed to the high concentrate inclusion in the total mixed ration and Fievez *et al.* (2001) reported that the levels of CP significantly alter ruminal pH. This may be attributed to higher ruminal NH_3-N that may result when feeding high level of CP. Volatile fatty acids are the main energy sources for ruminants feeding solely on roughages, thus their concentration in the diet gave indication of their energy values. The value ranged between 33.05 – 44.87 Mmol/100ml in this study which was above 28.8- 56.8 Mmol/100 ml reported by Adamu (2015) when groundnut haulm was fed to Yankasa rams and 19.57-36.57Mmol/l reported by Jokthan (2007) when pigeon pea forage was supplemented in sheep diet. Ahmed (2019) reported a TVFA (Total volatile fatty acid), concentration range (33.05 - 44.87 mmol/100ml) obtained in his study when he fed *Brachiaria ruziziensis*: concentration TMR to growing Yankasa rams. The increase in rumen TVFA in this study is possibly due to increased digestibility of the feed material. The significant increase in the rumen ammonia (NH_3-N) can be attributed to lower fermentation process due to low concentrate inclusion in the ration mixture. The increased concentration of NH_3-N with increasing CP content was observed by Gaafar *et al.* (2009). The rumen NH_3-N concentration of 12.30 mg/100ml in this study was within the range of 11.42-14.43mg/100ml recorded by Jonas and Vilma (2007) but was lower than 19-25mg/100ml observed by Mehrez *et al.* (1977). Powel *et al.* (1981) reported that between 3.6-17mg/100ml NH_3-N

concentration promotes microbial protein production which is an important factor in determining the utilization of nitrogen in the rumen (Jokthan,2007). Also, the increased concentrations of NH_3-N may be attributed to the ruminal degradation of CP (Mathieu *et al*., 1998). Higher ruminal NH_3-N concentration is accompanied with an increase in the level of dietary CP. Similar results were observed by Al-Malah (2007). Shamoon *et al*. (2009) and Chen *et al*. (2010) who observed that NH_3-N level increased with increasing CP level. The increased concentration of NH_3-N was mainly explained by a higher production of ammonia from the degradation of proteins in the rumen (Mathieu *et. al*., 1996). The primary limitation to the growth of rumen microorganisms on fibrous diets is probably the NH_3-N concentration. Which must be above the critical level (50mg/lt) for a considerable period of the day (Satter and Slyter, 1974). They also reported that a deficiency of NH_3-N concentration resulted in a reduction in rumen microbial population. Orskov and Ryle, (1990) reported that once the pool size of microorganisms decreases, digestibility of fibrous feed decrease and intake will fall. The ideal concentration of rumen NH_3-N for an efficient digestion has been estimated at 50-70 mg/lt (Satter and Slyter, 1974) and 150 t0 200 mg/lt (Kreb and Leng 1984, Prston 1986). Boniface *et al*. (1986) reported the optimum rumen NH_3-N concentration range 45-120 mg/lt but the value of Perdock (1987) was about 200mg/lt.

Table 6: Interactive effects of feeding Brachiaria Mulato II base Total mixed ration to growing Yankasa Ram at different percent body weights and hours of sampling on some rumen metabolites

	Parameter				
Hours	**PBW (%)**	**Temperature (^{0}C)**	**pH**	**TVFA (mmol/100ml)**	**RumenNH_3-N(mg/lt)**
0hr	2.5	31.00^a	6.77a	21.67^{bc}	43.00^c
	3	30.50^b	6.78^a	24.67^a	53.00^{ab}
	3.5	30.50^b	6.87^a	19.67^c	60.00^a
	4	31.50^a	6.77^a	23.33^b	50.00^b
SEM		0.286	0.021	1.246	3.00
4hr	2.5	30.50^b	6.78^b	19.66^c	43.00^c
	3	30.50^b	6.77^b	23.33^a	47.00^c
	3.5	31.50^a	6.77^b	23.33^a	50.00^b
	4	31.50^a	68.87^a	21.33^b	63.00^a
SEM		0.286	0.021	0.921	2.00
6hr	2.5	32.50^a	6.57^a	24.00^a	47.00^b
	3	31.97^a	6.77^a	22.00^b	43.00^c
	3.5	32.17^a	6.72^a	19.33^c	47.00^b
	4	32.00^a	6.62^a	21.67^b	53.00^a
SEM		0.309	0.034	0.907	3.00

$^{a, b, c:}$ Means with different superscripts within a row differed significantly (P<0.05). SEM= Standard Error of Means. * Significant at 5%, PBW= Percentage body weight, TVFA= Total volatile fatty acids.

CONCLUSION:

It could be concluded that Feeding *Brachiaria* Mulato II base total mixed ration at 4% body increase Nutrient digestibility of dry matter by 88.38% and Crude protein by 89.70%, with optimum nitrogen retention and rumen metabolites profile for proper function.

REFERENCES

Abdu, S. B., Hasan, M. R., Adamu, H. Y., Yashimi, S. M., and Abdullahi, M. J. (2012). Intake, Nutrient Digestibility and Nitrogen Balance of *Acacia auriculate, Gmelina arborea, Albizia lebbeck and Butryospermum parkii* by Yankasa Bucks. *Iranian Journal of Applied Animal Science, 2*(2): 121–125.

Adamu.H.Y. (2015). Assessment of two Groundnut (*Arachis Hypogaea L*) Varieties for Forage,Pod Yield Characteristics and Effect of Feeding the Haulm to Yankasa Rams. Ph.D Thesis Pp 72-82.

Al-Mallah, O.D.M., (2007). Effect of protein levels in formaldehyde treated rations on coefficient of digestion and performance in Awassi lambs. PhD. Thesis, University of Mosul.

AOAC, (2005). Official Method of Analysis, 17th edition. Association of Analytical Chemists, 24th edition Washington, DC. USA. 200-210.

Alabi, J.B., Yahaya, M.S., and Julius, N. (2010). Effect of Sorrel seed (Hibiscus sabdariffa) supplementation on the performance of Yankasa rams fed Brachiaria decumbens as basal diets. *Journal of Agriculture and Veterinary Science.* Pp: 7: 12-13.

Ajayi, F.I., Ogunleke, F.O., Odejide, J.O., Tiamiyu, A.K., and Morankinyo,O.A.(2014). FeedIntake and Weight Changes of West African Dwarf Goats Fed Concentrâtes Diet with Corn cobinvaryinglevels. Proc. 39th Conf.Nig.Soc.For Animal Prod. 16-19 March, 2014. Babcock Univ. Ilishan-Remo, Ogun State, Nigeria. Pp 262-264.

Babayemi, O. J. (2009). Silage quality, dry matter intake and digestibility by West African dwarf sheep of Guinea grass (*Panicum maximum cv Ntchisi*) harvested at 4 and 12-week regrowths. *African Journal of Biotechnology,* 8 (16): 3983-3988.

Bamikole, M. A., Akinsoyinu, A. O., Ezenwa, I., Babayemi, O. J., Akinlade, J. and Adewuni, M. K. (2004). Effect of six-weekly harvests on the yield, chemical composition and dry matter degradability of *Panicum maximum and Stylosanthese hamata* in Nigeria, *Grass and Forage Science*, 59:357-370.

Bello.A.A (2016).Economics of feeding sun-dried poultry dropping based diets on growing rams consuming sorghum

stover. *Iranian Journal of Applied Animal Science*. 6(3), 595-598.

Bogoro, S. E., (1997). Effect of protein energy supplementation on rumen kinetics, metabolites profile and growth performance of rams fed high fiber diets. Ph.D thesis, Abubakar Tafawa Balewa University, Bauchi, Nigeria.

Boniface, A.W., R.M. Munay and J.P Hogan 1986. Optimum level of Ammonia in the rumen liquor of cattle fed tropical pasture hay. Proceeding Australia Society of Animal Production. 16:151.

Chen, S., Paengkoum, C. P. Xia, X and Na-Lumpang, P., (2010). Effects of dietary protein on ruminal fermentation, nitrogen utilization and crude protein maintenance in growing Thai-indigenous beef cattle fed rice straw as roughage. *Journal of Animal and Veterinary Advances.* 9: 2396-2400.

CIRAD. French Agricultural Research Centre for International Development (2004). Fonio: An African cereal crop. Available at: www.cirad.fr/en. Retieved 28 October, 2006.

CIAT (Centro Internacional de Agricultura Tropical) (2006). Annual report 2005 project I.P-5 Tropical Grasses and legumes. Optimizing genetic diversity for multipurpose use: Pp 266.

Duncan D.B. (1955). Multiple range and multiple F-test. *Biomet-ric.* 11**:**1-42.

FAO (1995). Food and Agriculture Organization of United Nations. *Food and Nutrition Series*, No.27.

Food and Agricultural Organization (FAO, 2006). FAO, Statistics on ruminant animal livestock population in Nigeria. Rome, Italy. Pp. 61.

Fievez, V., De Fauw, K., Notteboom, K. Demeyer, D., (2001). Effect of level and origin of rumen degradable nitrogen on rumen microbial growth and nitrogen utilization efficiency of animals fed maize silage at maintenance. *Reproduction Nutrition Development*.,41: 349–364.

Gaafar, H.M.A., Mohi El-Din, A.M. A., Basiuoni, M.I., El-Riedy. K.F.A. (2009). Effect of concentrate to roughage ratio and baker's yeast supplementation during hot season on performance of lactating buffaloes. Slovakia, *Journal of Animal Science.* 42, (4): 188 – 195.

Galip, N. (2006). Effects of dietary *Saccharomyces cerevisiae* live yeast culture supplementation on ruminal digestion and protozoa count in rams fed with diets with low or high ratio forage/concentrate. *Revue de Médecine Véterinaire.* 157 (12): 609-613.

IAR (2017). Institute for Agricultural Research, Ahmadu Bello University, Zaria. Meteorological Data Information of Samaru and its Environs.

Jokhtan, G.E. (2007). Effect of supplementing Rice straw with pigeon pea forages on rumen and blood Metabolites of Yankasa sheep. A seminar paper presented at the Department of Animal Science ABU Zaria, 18th May 2006.Pp 1-15.

Jonas, J. And Vilma, V. (2007). Effect of l.planetarium, pediococus Acdilactici,Enterococcus faectum and l. Lactis microbial supplementation of grass silage on the fermentation characteristics in rumen of dairy cows. V*eterinary Journal of Zootechnika*, 40(62) 29 pts@Igi.It

Maigandi. S. A. and Wasagu. A. A. (2002). Nutrient intake and digestibility by Yankasa rams fed varying levels of *Ficus sycomorous* leaves, *proceeding of the 27th conference Nigerian Society for Animal Production* (NSAP) held at Federal University of Technology. Akure
Pp.182-184.

Mathieu, F., Jouany, J.P., Sénaud, J. Ohatier, J.B. Bertin, G. Mercier, M. (1996). The effect of Saccharomyces cerevisiae and Aspergillus oryzae on fermentations in the rumen of faunated and defaunated sheep; protozoal and probiotic interactions. *Reproduction Nutrition Development*, 36,271-287.

Mehrez, A.z, Orkskov, E.R. andMcdonald, I. (1977) Rates of rumen fermentation in relation to ammonia concentration. *British Journal Nutrition.* 38: 437-443

McDonald, P., Edward, R. A., Greenhalgh, J. F. D., Morgan, C. A., Sinclair, L.A.and Wilkinson, (2011). *Animal Nutrition*. 7th Edn., Prentice Hall/Pearson Education Ltd., Harlow, UK.

Nsinamwa, M., Moleele, N.M. and Sebego, R. J. (2005). Vegetation patterns and nutrients in relation to grazing pressure and soils in the sandveld and hardveld communal grazing areas of Botswana. *African Journal of Range Forage Science*. 22: 17–28.

NASS, (2011). National Agricultural Sample Survey Census on Nigerian livestock. Ministry of Agriculture and Rural Development.

National Research Council *(2007). Nutrient Requirements for various classes of sheep and goat, Update 2007. National Academy Press, Washington, DC.*

Kibon, A. and. Ørskov, E. R. (1993). The use of degradation characteristics of browse plant to predict intake and digestibility of goats. *Animal Production*, 57: 247-251.

Kopu, M. M. (1975). The natural forage for Northern Nigeria 2. Nitrogen and mineral composition of grasses and browse from northern Guinea savannah and standing hay from different savannah zones. *Nigerian Journal of Animal Production*, 2: 235-246.

Krebs, G and R.A Leng. 1984. The effect of supplementation with molasses/urea block on ruminal digestion. Proceeding. Australian Society of Animal Production.15:704.

Leng, R.A (1990) Factors affecting the utilization of poor-quality forage by ruminants particularly under tropical conditions *Nutritional Research Review* 3:277-303.

Ørskov, E. R. (1998): Feed Evaluation with emphasis on fibrous roughages and fluctuating supply of nutrients. 1. A review. *Small ruminant Research*, 28: 1-8.

Ørskov, E. R. and M. Ryle. 1990. Energy Nutrition in ruminants. Elsevier Applied Science, Oxford.

Ørskov, E. R. and Hovell, D. F (1978). Rumen digestion of hay (measures with Dacron bags) by cattle grain sugar cane or pangola hay. *Tropical Animal Production* 3: 9-11.

Okeniyi, F. A., Aina, A. B. J., Onwuka, C. F. I. and Suwande, S. O. (2010). Nutrient digestibility of urea maize stover-based diets as dry season feed in West African Dwarf Goats. *Proceedings of the 15th Animal Science Conference Association of Nigeria*, University of Uyo, Nigeria. Pp 663-665.

Okojie, J. A. (1999). The role of government and Universities of Agriculture improving animal production and consumption in Nigeria, *Tropical Journal of Animal Science*,2: 1-7

Osuji, P. O., Nsahlai, I. V, and Khalili, H. (1993). *Feed Evaluation* (ILCA Manual.,No 5). Addis Ababa, Ethiopia: ILCA (International Livestock Centre for Africa) 40.

Osinowo, O. A., Abubakar, B. Y., Adewuyi, A. A., Onifade, O. S. and Dennar, P. O. (1991). Estimates of genetic and phenotypic parameters of birth weight, weaning weight and pre-weaning gain in Yankasa sheep. In *The Proceedings of the 16th Annual Conference of the Nigerian Society for Animal Production, Usmanu Danfodio University*. Sokoto, Nigeria.

Ovimap, (2015). Ovi location map: Ovi Earth Imagery Data. Perdock H.B. 1987 Ammoniated rice straw as a feed for growing cattle Ph. D Thesis University of New England Armidale New Australia.

Powel, M.P., Okorie, A. O, Okorie, A. U, Peter, J.B. Wilhain, H.Dyfed, L (1981) Amonia Concentration and protein Synthesis in the rumen. *Journal of science food Agriculture*, 32:759-763.

Preston, T.R., and R.A., Leng, (1987). Matching Ruminant production system with Available Resources in the tropics and subtropics. Penambul Books Ltd, Arnidale NSW Australia. Pp 245.

Quala, I.D. Yahaya,M.S. Midau,A. Aji,S.B. Muktar,Y.M. and Nyako, H.D. (2011). Assessment of the Digestibility of intercropped sorghum stover with legume (Groundnuts). *Global Journal of Science Frontier Research.*11(3):45-54

SAS, (Statistical Analysis Systems). (2002). Procedures Guide. North Carolina, USA: Statistical Analysis Systems Institute, Cary.

Satter, L.D and L.L Slyter 1974. Effect of rumen ammonia Concentration on rumen microbial population In vitro. *British Journal* 34:199-208.

Sani I. (2012). Effect of Different protein supplementation on the performance of Yankasa sheep fed Congo grass (*Brachiaria ruziziensis*). Pp 64-69.

Schultze-Kraft, R. and Teitzel, J. K. (1992) *Brachiaria ruziziensis* Germain & Evrard. In: 't Mannetje, L. and Jones, R.M. (eds) *Plant Resources of South-East Asia No. 4. Forages*. pp. 65–67. (Pudoc Scientific Publishers, Wageningen, the Netherlands).

Shamoon, M., Saleh N., Abbo N.Y. (2009). Effects of different levels of protein treated with formaldehyde on nutrients digestibility and some rumen and blood parameters in Awassi sheep. Iraqi *Journal of Veterinary Science.* 23, Supplement II, 169-173.

Singh, R. J. (2009). *Genetic resources, chromosome engineering and crop improvement: Forage crops*. CRC Press, Florida, U. S. A. Pp 8-12.

Silva, H. G. de O., Pires, A. J. V., Cunha Neto, P. A. da, Carvalho, G. G. P. de, Veloso, C. M. and Silva, F. F. da (2007). Digestibility of nutrients in diets containing ammoniated elephant grass and cocoa meal or palm kernel cake fed to sheep. *Revise Brasilia Zootec.*, 36 (2): 499-506.

Trinh, P. H., Ho, Q. D., Preston, T. R. and Leng, R. A. (2009). Nitrate as a fermentable supplement for goats fed forage basal diet low in protein. *Livestock Research for Rural Development*, 21(10). Retrieved August, 10th June 2016, from www.Irrd22/5/sing22093.htm

Umunna, N. N., Nshalai., I.V. and. Osuji, P.O. (1995). Degradability of protein forage supplement and their effects on kinetics of digestion and passage, *Small Ruminant Research*. 17: 145-152.

Usman, H. B., Maigandi, S. A., Hassan, W. A. and Daneji, A. I (2008). Growth performances and Nutrient Utilization by Sokoto red goat Kids fed fore stomach digesta as replacement for cowpea husk. *Nigerian Journal of Basic and Applied Science*, 16(1):62-70.

Van Soest, P. J., Robertson, J. B. and Lewis, B. A (1991). Method for directory Neutral detergent fibre and Non- Starch polysaccharides in relation to Animal Nutrition, *Journal of Dairy Science*, 74: 3583-3597.

Wada, N. I., Njidda, A. A. Olafadehon, O. A. and Bello, B. (2016). Effect of graded level of *Parkia biglobosa* in concentrate diets on growth performance, digestibility and nitrogen utilization of Yankasa rams. *Nigerian Journal for Animal Production*, 43(1): 231-238.

Watson, L. and Dallwitz, M. J. (2008). The grass genera of the world: Descriptions, illustrations, identification and information retrieval; including synonyms, morphology, anatomy, physiology, phytochemistry, cytology, classification, pathogens, world and local distribution and references. *The Grass Genera of the World. Retrieved from* http://www.tropicalforages.info/key/Forages/Media/Html/glossary.html. 2011-11-07

Yashim, S. M., Jokthan, G. E., Lamidi, O. S., Yakubu, R. L. Hassan, M. R., Ibrahim, T. A. and Abdu, S. B. (2014). Performance, nutrient digestibility and nitrogen balance of growing Yankasa rams fed *Digitaria smutsii* hay supplemented with *Ficus sycomorus* leaf meal. *Nigerian Journal for Animal Science*, 16(1): 85-93.