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Nutrient Digestibility and Economy of Feeding Crushed Millet Stover Balanced Rations with Non-Protein Nitrogen Sources to Yankasa Rams

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ABSTRACT

The use of conventional feedstuffs as supplements to quality feed may not be cost effective in Nigeria presently to intensify production, owing to their high cost and irreplaceability and the competition both with humans and monogastric animals. The experiment was conducted in the Ruminant Unit of Professor Lawal Abdu Saulawa Teaching and Research Farm, Federal University Dutsin-Ma, Katsina State, to determine the nutrient digestibility and evaluate the economy of feeding Yankasa rams with crushed millet stover balanced rations containing different non-protein nitrogen sources. Twenty rams with initial average weight of 21.40-25kg were replicated 5 times in 4 treatments using completely randomized design (CRD). Each diet was fed ad libitum, for 60 days. Highest dry matter digestibility ($p<0.05$) was in D3 (89.00%) and lowest in D2 (83.79.00%). Organic matter digestibility was highest for rams fed with D3 (88.67%) and the lowest value was recorded in D1 (73.04%). Neutral Detergent Fibre (NDF) digestibility was also significantly ($p<0.05$) different among the diet groups. Rams fed diet 3 recorded the highest NDF digestibility of 91.88%, while the lowest was observed in D2 (87.52%). Digestibility of ADF was significantly ($P<0.05$) influenced by the diets. Rams fed with diet 4 had the highest mean (90.82%) rams fed with diet 2 (87.33%) recorded the least value. Crude protein digestibility was also significantly different ($P<0.05\%$) among the diets. The highest value of 92.55% was obtained in diet 3 and the lowest was obtained in D4 (87.41%). Findings from this study revealed that incorporation of crushed millet stover with urea and dried poultry litter improved its digestibility. Yankasa rams on 1kg urea alone gave least total cost of feed (₦) and least cost of feed per kilogram weight gain (₦) as such, may be recommended for feeding Yankasa rams.

Key words: Cottonseed cake, Maize Offal, Poultry Litter and Urea

INTRODUCTION

Livestock production has vast potential of increasing the Nation's economy in different ways. In addition, Oluwafemi *et al.* (2001) highlighted that the contributions of the agricultural sector to the Nigerian economy during the pre- and post-colonial eras when agriculture was the dominant economic driver cannot be overstated. Small ruminants such as sheep are second most important livestock species in Nigeria, with a population of 42,091,042 million (FAO, 2016). Small ruminants provide a source of income and employment for many Nigerians, particularly women and youth, who are involved in small-scale production, processing, and marketing of small ruminant products. (Ademosun, and Adeyemi, 2019). Small ruminants are particularly important in regions where other livestock species are less suitable, such as in dry and arid areas. They are known for their adaptability, hardiness, and their ability to convert low-quality feeds into high-quality protein sources. As a result, small ruminants are an essential source of meat, milk, wool, and hides, and they provide income and employment opportunities for many small-scale farmers. (FAO, 2021).

Goats and sheep are particularly valued for their meat, milk, and skin, and they provide a

valuable source of nutrition for households in remote areas. Furthermore, small ruminants are an important source of foreign exchange earnings through exports of meat, skins, and wool. (Ayantunde, *et al.,* 2013). Because of their high cost and irreplaceability (Akinmutimi, 2004), as well as competition from humans and monogastric animals, the use of conventional feedstuffs such as cotton seed cake, soybean cake, fishmeal, and others as a supplement to quality feed may not be cost effective in Nigeria (Adama, 2008 and Ajayi *et al.,* 2008). As a result, non-conventional energy and protein sources derived from farm and agro-industrial wastes are currently being used in Nigeria for animal production (Ndubueze *et al.,* 2006). Therefore, feed resources should be cost-effective, of nutritiously high-value, non-toxic, easily accessible, have low demand from both humans and other livestock species, and have no industrial application. Seasonal variations in the availability and quality of pastures affect livestock productivity in most developing countries, notably those in arid and semiarid regions of Sub-Saharan West Africa (Castrillo-Caamal *et al.,* 2003). The objective of the research is to determine the effect of feeding complete diets containing poultry litter and urea treated millet stover on the economic analysis in Yankasa rams.

MATERIALS AND METHODS

Study Area

The experiment was conducted at the Professor Lawal Abdu Saulawa Teaching and Research Farm, in the Small Ruminant Unit of the Federal University Dutsinma, Katsina State. Dutsinma LGA lies on latitude 12^{o} 27'16.128'N and longitude 07^{o}29'5544E. It has a land area of about 527, km^2 (203 sq 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 (Encyclopedia Britanica, 1998; Katsina, 2006).

Experimental Animals

A total of twenty (20) Yankasa rams with an initial weight range of 21.40 – 25.20 kg were used for the study. The rams were given prophylactic treatments, made up of oxytetracycline L. A. (Kepro®) 20%, at 1ml per 10kg body weight were injected intramuscularly. They were dewormed with Albendazole at $12.5mg/kg^{1}$ body weight against internal parasites and their bodies were sprayed with acaricide, using Amitraz® 1ml/litre against external parasites.

Preparation of Experimental Diets

Four diets were formulated using 'Gawo' (*Faidherbia albida*) pod meal FAM, maize offal, Cotton seed cake (CSC), dried poultry litter (DPL) and urea. One kilogram of Grade Urea 46–N was dissolved into twenty-five litres of water and sprinkled on fifteen kilogram crushed millet stover for treatment diet three and four (T3 and T4). The CSC, DPL and, crushed Urea treated millet stover and maize offal (MO) were mixed into complete diets. The diets were formulated in such a way that either of the two non- protein nitrogen sources or both were included in the four treatments except in treatment 1 which served as a control diet.

Total feed consumed per kilogram per diet was calculated by dividing total feed consumed by total cost of feed per diet. Total cost of feed was calculated by adding all the prices of ingredients involved in making the supplements. Total cost of feed per kilogram per liveweight gain per Naira (₦) was calculated by dividing average total cost of feed per Naira (₦) per diet by average total weight gain in kilogram (Kg) per diet.

Treatment and Experimental Design

Animals of similar weights were randomly allocated to 4 treatment combination of five (5) animal/treatment arranged in a completely randomized design. The treatments were: T1 (control diet DPL/UREA (0.00:0.00)) T2 (DPL/UREA (15.00:0.00)) T3 (DPL/UREA (0.00:1.00) T4 (DPL/UREA (15.00:1.00)). The composition of ingredients is shown in Table 1.

Housing and Management

Each animal was offered the feed *ad libitum* in the morning at 8:00 a.m. and at 3:00 p.m. in the

afternoon. The total daily allocation of the diets was adjusted on the basis of the previous day's intake. The experiment lasted for 60 days after allowance of 14 days period for adaptation to confinement. Fresh drinking water was provided in graduated plastic containers.

Nutrient Digestibility (%)

After the feeding trials, three rams were randomly selected from each treatment which served as representative of each treatment. They were placed in an individual metabolic crate with slanted floors adopted for faecal and urine collection. After a week (7days) of adjustment to the experimental diets and the metabolic crates, nutrient digestibility was conducted. The rams were maintained on their respective diets throughout the 7-day period. Volume of faeces and urine voided were collected daily for seven days, 10% of faecal sample collected and was oven dried at 65^{o}C for three days to determine the dry matter. Volatilization of Nitrogen from urine was prevented by using a urine collection container coated with 10mls of 10% H_2SO_4 where 10% of the daily urine voided was collected and stored in a refrigerator at 4^{o}C until bulked for each ram and analysed for nitrogen content. Apparent digestibility of the diets was calculated as the difference between nutrient intake and excretion in the faeces expressed as percentage of the nutrient intake (Marshal, 2001; Aduku, 2004).

Data Analysis

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

RESULTS AND DISCUSSION

Ingredients Composition of Crushed Millet Stover Balanced Rations Containing Different Non-protein Nitrogen Sources fed to Growing Yankasa Rams

Ingredients composition of the experimental diet (Table 1) contained test ingredients, where *Faidherbia albida* pods meal and millet stover were constant across the four treatments, just as bone meal and salt were constant across all treatments. Maize offal and cottonseed cake were incorporated in different inclusion levels across the four treatments. The Control diet (Treatment 1) did not contain any of the two non-protein nitrogen sources (urea and dried poultry litter).

Table 1: Ingredients Composition of Crushed Millet Stover Balanced Rations Containing Different Non-Protein Nitrogen Sources fed to Growing Yankasa Rams in Katsina State, Nigeria

Ingredients (kg)		**Diets**			
		T1 DPL/UREA (0.00:0.00)	**T2 DPL/UREA (15.00:0.00)**	**T3 DPL/UREA (0.00:1.00)**	**T4 DPL/UREA (15.00:1.00)**
Faidherbia albida Meal	(FA)	30.00	30.00	30.00	30.00
Maize Offal	(MO)	33.80	27.50	34.00	27.50
Cotton Seed Cake	(CSC)	18.70	10.00	17.50	9.00
Dried Poultry Litter	(DPL)	0.00	15.00	0.00	15.00
Urea		0.00	0.00	1.00	1.00
Millet Stover	(MS)	15.00	15.00	15.00	15.00
Bonemeal		2.00	2.00	2.00	2.00
Salt		0.50	0.50	0.50	0.50
Total		100.00	100.00	100.00	100.00

FA = *Faidherbia albida* Meal; MO = Maize Offal; CSC = Cotton Seed Cake; DPL = Dried Poultry Litter; MS = Millet Stover

Nutrients Digestibility of Yankasa Sheep fed Complete Diets Containing Poultry Litter and Urea Treated Millet Stover

Dry Matter digestibility of the present study was significantly ($p<0.05$) different and the values were high, were similar to the range of values (78.00 – 80.00%) reported by Hadjipanayiotu (1990), 64.19 – 88.85% reported by Garba and Ado (2015). The results of (DMD) in this study indicated a higher DMD observed for animals on urea treatments over DPL rations. This confirms an earlier report by Olaleru (1995) and Abubakar (2008). This is not unconnected with the ability of urea to furnish the rumen with a higher microbial population than

DPL, resulting in increased digestibility of urea rations. However, the result revealed differences in dry matter digestibility among the treatments. This contradicted an earlier observation by Kraiem *et al.* (1994) who found no differences in the DMD of steers when fed soyabean and soyabean/urea in diets. This could be as a result of difference in the supplement combinations in the latter study.

Organic matter digestibility in this study is similar to those of Brosh *et al.* (1990) and Abubakar (2008). The effects of the diets on OMD seem to follow the same patternas DMD, with urea diets having better digestibility than DPL rations.

Crude protein digestibility values of the experimental diets in the present study were different significantly ($p<0.05$) among the treatments and higher when urea was fed separately in the diets. This is in conflict with the reports of Stock *et al.* (1981) that nitrogen digestibility was not affected when meat meal, blood meal corn gluten meal or their combination with urea were fed to lambs. However, lower CPD were observed for animals fed DPL and urea in the diets. This is partly in agreement with the reports of Rankins *et al.* (1993), who observed decreased CPD with high levels of poultry litter in diets. Generally, CPD indicated higher values across the diets (87.41 – 92.55%).

The mean values for the digestibility of neutral detergent fibre (NDFD) was higher for animals on urea diet than for those on DPL or a combination of DPL and Urea. These results agree with results of NDFD and ADFD in the present study agrees with those of Owen and Jayasuriya (1989) who observed increased NDFD of straw with urea supplementation, the report of Abubakar (2008) who obtained higher NDFD for animals on urea treatment than for those on CSC or a combination of CSC and Urea and that of Nourou (2010) who obtained higher NDF and ADF digestibility after supplementing groundnut haulms to millet stover based diet. The difference ($p<0.05$) in crude protein digestibility could be attributed to the increased protein and non-protein nitrogen sources in the diets (cotton seed cake, poultry litter and urea).

Table 2: Nutrients Digestibility of Yankasa Rams Fed Crushed Millet Stover Balanced Rations Containing Different Non-Protein Nitrogen Sources

Parameters	Diets				SEM	p-value
	DPL/UREA (0.00:0.00)	DPL/UREA (0.00:15)	DPL/UREA (0.00:1.00)	DPL/UREA (15.00:1.00)		
DMD (%)	84.74^{bc}	83.79^{c}	89.00^{a}	85.33^{b}	0.19	<.0001
OMD (%)	73.04^{d}	84.94^{b}	88.67^{a}	75.72^{c}	0.25	<.0001
NDFD (%)	88.81^{b}	87.52^{c}	91.88^{a}	89.87^{b}	0.18	<.0001
ADFD (%)	89.32^{b}	87.33^{c}	89.92^{ab}	90.82^{a}	0.17	<.0001
CPD (%)	88.26^{b}	88.77^{b}	92.55^{a}	87.41^{c}	0.09	<.0001

a, b, c, d, e = Means within rows with different superscripts are significantly different ($p<0.05$); Dried Poultry Litter DMD = Dry Matter Digestibility; OMD = Organic Matter Digestibility; NDF = Neutral Detergent Fibre Digestibility; ADF = Acid Detergent Fibre Digestibility and CPD = Crude Fibre Digestibility. Means with the same letter are not statistically ($p>0.05$) different; SEM = standard error of means, NS = Not Significant

Economic analysis of Yankasa Ram Fed Crushed Millet Stover Balanced Rations Containing Different Non-protein Nitrogen Sources

Total feed intakes were similar ($p>0.05$) among the diets which were in agreement with observations made by Yerima *et al.* (2020) where no significant difference was

reported and the values for block intake ranged from 4.25 – 6.76 kg. Similarly, total feed intake in this study was lower and contradicted the range of values of 18.14 – 19.93 kg reported by Audu *et al.* (2020). The values were also lower than 1.75 – 2.07 kg reported by Muhammad *et al.* (2016) and the range of values 0.90 – 1.76 kg reported by Mubi *et. al.* (2013).

The total cost of feed consumed (₦ 79.07 – 177.91) was significantly ($p<0.05$) different among the treatment diets which were lower than ₦ 262.01 – ₦ 401.5 and ₦9822.35 – ₦ 15522.59 reported by (Yerima *et al.,* 2020) and Muhammad *et al.* (2016). The least cost per kg gain (₦/kg) was obtained in treatment containing 1kg urea only (T3). The cost of feed per kilogram of weight gain was lower in T3 containing 1kg urea only, because animals in the diet had higher live weight gain. This is similar with findings of Audu *et al.* (2019) who reported lower cost of feed per kilogram of weight gain for animals fed diets containing fermented cassava peel meal where the animals in the group had higher live weight gain as supported by similar observations made by Maigandi *et al.* (2002).

Table 3: Cost of Feed and Cost of Feed per kg live weight gain of Yankasa Rams Fed Crushed Millet Stover Balanced Rations Containing Different Non-Protein Nitrogen Sources

Parameters	Diets				SEM	p-value
	T1 DPL/UREA (0:00)	T2 DPL/UREA (0:15)	T3 DPL/UREA 0:1	T4 DPL/UREA 15:1		
Total Weight Gain (Kg)	3.50	5.00	4.84	3.33	0.22	0.0018
Total Feed Intake (kg)	1.13	1.00	1.13	1.15	0.22	0.7752
Total Cost of Feed (₦)	79.2	177.6	79.1	177.9	11.31	<.0001
Cost of feed/kg/weight gain/(₦)	22.6	34.7	16.3	53.4	3.24	<.0001

CONCLUSION

Findings from this study revealed that supplementation of crushed millet stover with dried poultry litter and treated urea improved its intake and digestibility. Higher ($p<0.05$) dry matter digestibility 89.00%, organic matter digestibility 88.67%, neutral detergent fibre intake 91.88% and crude protein intake 92.55% were obtained in animals on urea diet only (T3). However, higher ($p<0.05$) acid detergent fibre (90.82%), was obtained in animals on dried poultry litter/urea (T4). Nitrogen intake, retention, retention as percentage intake in Yankasa rams were better ($p<0.05$) when they are fed with urea diets only. Also, least cost of feed and the cost of feed per kilogram of weight gain was lower for diet treated with 1kg urea.

Recommendation

Supplementation of 1% (1kg) of urea on crushed millet stover and other feed ingredients may be recommended for a complete diet in that, it gave better performance in nutrient intake and digestibility as it was more economical in the present research.

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