Asian Journal of Research in Animal and Veterinary Sciences

9(1): 16-21, 2022; Article no.AJRAVS.75548

Utilization of Urea Supplemented Fibrous Crop Residues by Yankasa Rams: Effect on Dry Matter Intake, Performance and Nutrients Digestibility

O. S. Gabriel [a*], J. I. Zubair [a] and F. O. Afolayan [b]

[a] Department of Animal Nutrition, Joseph Sarwuan Tarka University, Makurdi, Nigeria.
[b] Department of Agricultural Education, College of Education, Oro, Kwara State, Nigeria.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/75548

Original Research Article

Received 20 August 2021
Accepted 25 October 2021
Published 15 January 2022

ABSTRACT

The main aim of the 8 -weeks study was to assess the dry matter intake, weight gain and nutrients digestibility of *Yankasa* rams fed urea supplemented fibrous crop residues. Twenty (20) Yankasa rams weighing 15.0kg on average were allocated to four treatment diets which contained 0% (T1), 1.0% (T2), 1.5% (T3) and 2% (T4) fertilizer grade urea, in a completely randomized design. Yam peels, maize offal and rice offal were the basal ingredients. These ingredients were milled and combined with other ingredients to compound the experimental diets. Results of the study showed significant differences in all the parameters assessed, and animals fed diet containing 1.5% - 2% urea (T3 and T4) had better performance in terms, weight gain and nutrient digestibility (69.26 – 88.35%). It was therefore inferred that treating fibrous crop residue with urea at 1.5% - 2% of the total feed will improve performance and nutrients digestibility of Yankasa rams.

Keywords: Urea; supplementation; crop residues; rams; drymatter; intake; nutrients digestibility;

**Corresponding author: E-mail: onyi.zoe@gmail.com;*

1. INTRODUCTION

Inadequate nutrition especially during the dry season has been the major factor limiting the expansion of ruminant production in Nigeria. Most of the sheep found in Nigeria are kept under extensive management systems and depends almost exclusively on natural pastures for their nutrients requirement. The availability of these forages is mainly determined by the amount of rainfall and length of dry season. Therefore, sheep body weight gain depends on adequate quantities of herbage during the months of the wet season.. They, however, start losing weight at the onset of dry season and their condition deteriorates progressively throughout the dry season. This problem of nutrition inadequacy is further aggravated by the current increasing population coupled with decreasing arable and grazing lands. Thus, the growing interest in a shift from extensive to intensive systems of livestock management.

To salvage this problem, there is a need to explore further the utilization of cheap and indigenous sources of nutrients that have no competition from man and other types of livestock animals. The use of crop residue has been suggested [1]. This is because these animals can use fibrous feed to generate nutrients for maintenance and small level of production.

Moreover, Nigeria has not fully developed intensive livestock feeding systems, based on expensive and scarce feed resources, like grains and oil seed cakes, quality pastures. Therefore, farm wastes will continue to be important in Nigeria's livestock feed resources [2].

Most farm wastes have a peculiar limitation-low available protein and fermentable carbohydrates. The use of these farm wastes can, therefore, impair rumen performance since it has been reported that the rumen microbes' performance, and consequently ruminant animal performance is impaired when nitrogen content of diet is below 2% [3]. On the other hand, feeding of protein and energy supplements is known to enhance utilization of poor quality feeds like crop residues by maximizing rumen microbial growth and protein synthesis [4].

In the present study, an attempt was made to investigate the utilization of urea supplemented fibrous waste by Yankasa sheep.

2. MATERIALS AND METHODS

2.1 Study Site

The study was carried out at the Livestock Teaching and Research Farm of the Department of Animal Production, Federal University of Technology, Minna, Niger State. Minna is situated on latitude 9° North and longitude 7° East. It has a mean annual rainfall of 1200 – 1300mm, mean annual temperature of 38 - 42°C, and located in the Southern Guinea Savannah vegetation zone of Nigeria. The experiment was conducted between the months of April and June.

2.2 Experimental Animals and their Management

The study was conducted on sixteen Yankasa rams of age between 8 – 10 months and weighing 15.04 Kg on an average. The animals were purchased from local sheep rearers in villages around Minna, Niger State.

Prior to the rams introduction to the experiment, the pens were swept, washed and disinfected using Moriguard®. The rams were bathed (sprayed) against external parasites, dewormed with Levamisol® and vaccinated against PPR. The rams were thereafter randomly divided into four groups of four animals per group. The groups were randomly assigned to four dietary treatments which contained 0 (T1), 1.0 (T2), 1.5 (T3) and 2.0% (T4) fertilizer grade urea in a completely randomized design. The diet contained fibrous basal ingredients such as yam peels, maize bran and rice offal.

The feeding trial covered a period of 8 weeks during which the experimental diets and clean water were provided *ad libitum*, left overs were collected daily and weighed.

2.3 Preparation of Experimental Diets

Yam peels, maize bran and rice offal were the basal ingredients. Yam peels were obtained from restaurants and fried yam sellers in Minna metropolis, while rice offal and maize bran were obtained from cereals mills within Minna. Fertilizer grade urea was purchased from agro-chemical sellers in Minna. The yam peels were milled to improve utilization and proper mixing with the other ingredients.

Four experimental diets were formulated to contain 0, 1, 1.5, and 2% urea for treatments 1, 2, 3 and 4 respectively (Table 1)

2.4 Data Collection and Statistical Analysis

Daily feed intake: The experimental feed was weighed out (7 kg) for each animal at the start of a week and 500g of the weighed out feed was offered to each animal daily. The daily left overs were collected and weighed at the end of the week. The weekly feed intake was determined as the difference between feed served and feed left overs per week.

The average daily feed intake per animal was calculated as follows:

$$Average\ daily\ feed\ intake = \frac{\Sigma\ \text{weekly feed intake}}{Duration\ of\ study\ (in\ days)}$$

Weight gain: The weekly weight gain per animal was determined as the difference between the current week's weight and the previous week's weight. The weekly weight gain data per animal was used to calculate the average daily weight gain as follows:

$$Average\ daily\ weight\ gain/animal = \frac{\Sigma\ \text{weekly weight gains}}{Duration\ of\ study\ (in\ days)}$$

Digestibility Trial: The last 14 days of the feeding trial was used to determine digestibility. The rams were transferred to metabolic cages and allowed 7days to adjust to the cages. Urine and faecal samples were collected during the last 7 days. The faeces were weighed and oven dried at 105°C for 48 hours for DM determination. The faecal samples collected from each animal were bulked and thoroughly mixed, milled and sealed in polythene bags. These were stored in a dry cupboard until required for chemical analysis.

Urine excreted by each animal was collected in a plaque bucket under each cage and to which few drops of H_2SO_4 was added daily to prevent volatilization of ammonia from the urine. The total volume of urine output per animal was measured and aliquots of daily output per animal was saved in stopper plastic bottles and stored in deep freezer.

Nutrients intake and digestibility coefficient of the rams were calculated using the following formula:

$$\text{Nutrients Digestibility} = \frac{\text{Nutrient in feed} - \text{Nutrient in Faeces}}{\text{Nutrient in feed}}\ X\ 100$$

2.5 Laboratory Analysis

Samples of the experimental diets and faeces were analysed to determine their chemical composition in the laboratory using method [5], fibre fractions were determined [6]. The fibre fractions determined were Neutral detergent fibre (NDF), acid detergent fibre (ADF) and acid detergent lignin (ADL). Hemicellulose was calculated as the difference between NDF and ADF, while cellulose was determined as the difference between ADF and ADL.

Data generated were subjected to one-way analysis of variance using general linear model procedure of SAS (2008). Where significant differences were observed, Duncan's New Multiple Range Test was employed to compare means

Table 1. Ingredient composition of experimental diets

	Experimental Diets			
Ingredients	**D1**	**D2**	**D3**	**D4**
Yam peels	40	40	40	40
Maize bran	20	20	20	20
Rice offal	39	37.5	37	36.5
Urea	0	1.0	1.5	2.0
Salt	0.5	0.5	0.5	0.5
Bone meal	0.5	0.5	0.5	0.5
Sulphur	0	0.5	0.5	0.5
Total	100	100	100	100

D1 (Control; 0% urea), D2 (1% urea), D3 (1.5% urea), D4 (2% urea)

3. RESULTS AND DISCUSSION

3.1 Proximate and Fibre Fractions Composition of the Experimental Diets

Table 2 presents the proximate and fibre fractions compositions of the experimental diets. The crude protein of the diets increased with increasing urea content. The values ranged from 8.87% (D1) to 13.84% (D4). The values were within the recommended level 9-14% for sheep [7], and 10 – 12% for ruminants [8]. The crude fibre (CF) content varied slightly and was between 14.92% (D3) and 16.27% (D1). The fat content of the diet was between 3.67% (D2) and 4.83% (D1). The values were within limit required for good rumen microbial activity [4]. The nitrogen free extract ranged from 61.82 – 66.19%. This is an indication that the diet contained appreciable amounts of fermentable carbohydrates.

The quality of the CF was proper as it was high in hemicellulose and NDF and within proportion that can be utilized by ruminants [9].

3.2 Performance of Yankasa Rams fed Urea Supplemented Fibrous Waste

Table 3 presents the results of performance of Yankasa rams fed urea supplemented fibrous waste. Urea supplementation was found to significantly ($P<0.05$) improve daily weight gain, dry matter intake and feed conversion ratio. The values for these parameters were highest in rams in T4 (45.55g, 298.39g and 6.61g respectively). Rams in T1 had the least values for these parameters (11.47g/day, 219.46g, and 19.11g respectively). The values obtained for average daily weight gain (11.47 – 45.55g/day) were higher when compared with 8.86 – 39.05g/day, reported for goats [10] and lambs [11] fed crop residues with urea molasses multi-nutrients block supplements. The improved performance in terms of daily weight gain, dry matter intake and consequently feed conversion ratio, could be attributed to the increased nitrogen content of the diet since nitrogen has been shown to improve rumen microbial population and thereby enhance the utilization of non-nitrogenous component of feed stuff [4].

Table 2. Proximate and fibre fractions composition of the experimental diets

	Experimental Diets			
Proximate Composition (%)	**D1**	**D2**	**D3**	**D4**
Dry matter	94.08	92.81	93.26	93.07
Crude protein	8.87	11.76	13.07	13.84
Crude fibre	16.27	15.98	14.92	16.12
Ether Extract	4.83	3.76	4.11	3.85
Ash	10.04	11.99	12.08	10.40
NFE	66.19	62.51	61.82	62.79
Fibre fractions (%)				
NDF	71.34	69.96	72.54	70.33
ADF	43.42	43.38	42.08	41.95
Hemicellulose	27.92	26.58	30.46	28.38

D1 (Control; 0% urea), D2 (1% urea), D3 (1.5% urea), D4 (2% urea). NFE Nitrogen free extract; NDF Neutral detergent fibre; ADF Acid detergent fibre

Table 3. Performance of Yankasa Rams fed urea supplemented fibrous waste

	Experimental diets					
Parameter	**T1**	**T2**	**T3**	**T4**	**SD**	**P-Value**
Initial Weight (kg)	15.04	14.96	14.88	15.13	0.09	0.001
Final weight (kg)	15.68	16.22	17.41	17.10	0.69	0.001
Daily weight gain (g/day)	11.47^{c}	22.59^{b}	45.22^{a}	35.22^{b}	1.27	0.012
Dry matter intake (g)	219.46	220.25	298.76	260.39	32.80	0.013
FCR	19.11^{c}	9.74^{b}	6.61^{a}	7.39^{a}	0.49	0.021
Mortality rate	0.00	0.00	0.00	0.00	-	-

Means with different superscript are significantly different (P<0.05)
T1 (Control; 0% urea), T2 (1% urea), T3 (1.5% urea), T4 (2% urea)
FCR Feed conversion ratio, SE Standard Error.

Table 4. Nutrients and fibre fractions digestibility of Yankasa Rams fed urea supplemented fibrous waste

	Experimental diets					
Nutrients	**T1**	**T2**	**T3**	**T4**	**SE**	**P-Value**
Dry matter	87.28	84.72	88.35	88.78	0.332	0.852
Crude protein	78.65^{b}	85.98^{a}	87.62^{a}	85.12^{a}	0.461	0.049
Crude fibre	71.89	75.32	78.94	75.34	0.680	0.438
Ether extract	76.93^{a}	71.58^{b}	78.58^{a}	76.42^{a}	0.638	0.042
Nitrogen free extract	65.61	64.24	69.26	68.48	0.883	0.142
Neutral detergent fibre	69.95^{c}	76.40^{ab}	77.48^{a}	74.48^{b}	0.726	0.021
Acid detergent fibre	69.86^{c}	74.13^{b}	77.32^{a}	74.67^{b}	0.719	0.016
Hemicellulose	70.08^{c}	79.09^{a}	77.71^{a}	74.19^{b}	0.746	0.043

Means with different superscript are significantly different (P<0.05)
T1 (Control; 0% urea), T2 (1% urea), T3 (1.5% urea), T4 (2% urea)
SE Standard Error

3.3 Nutrients and Fibre Fractions Digestibility of Yankasa Rams fed Urea Supplemented Fibrous Waste

The result of nutrients digestibility in this experiment (Table 4), indicated a relatively high nutrients digestibility in all the rams. This reveals that the diets were palatable and digestible. the coefficient of digestibility of dry matter (DM), crude fibre and nitrogen free extracts did not differed significantly (P>0.05) across the dietary treatments. The values ranged from 84.72 (T2) to 88.78% (T4), 71.69 (T1) to 78.94% (T3), and 64.24 (T2) to 69.23% (T3) respectively. The digestibility of the other nutrients (Crude protein and ether extracts), and fibre fractions were significantly (P<0.05) improved by urea supplementation. The values for coefficient of digestibility of all the nutrients were observed to be higher in T3 and T4 (1.5 and 2% urea supplementation) . This is an indication that suplementing crop residues with urea at 1.5 to 2% could optimize nutrient utilization by rams. This finding is in concordance with the report [4] that best results of nutrient digestibility are obtained when urea supplementation is between 1.5-2.0%.

The coefficient of digestibility of crude protein ranged between 78.65% (T1) to 85.12% (T2). These values were higher when compared to 32.58 to 61.34% reported [12] for lambs fed crop residues with urea molasses blocks supplements. The high CP digestibility could be responsible for the high crude fibre (CF) digestibility observed (71.69% to 78.94%), because the rumen microbial biomass has sufficient nitrogen for multiplication and hence degradation of the cell wall components. These CF digestibility values were higher 52.65 – 67.64% than the report [10] where the goats were fed cassava peels with urea-molasses multi-nutrients block.

The observed digestibility of nitrogen free extracts (NFE) is an indication that the fermentable carbohydrates were efficiently utilized and enough energy was available for optimum rumen microbial activity since microorganisms in the rumen requires readily source of fermentable carbohydrate for protein synthesis and other activity to proceed optimally [4]

4. CONCLUSION

Results obtained from this study reveals that performance indices measured for Yankasa rams fed urea supplemented fibrous waste, compares with that from combination of conventional and competitive oil seed meals, maize and wheat/maize offal. Therefore, the treatment of crop residues with 1.5-2.0% urea will reduce pressure on conventional protein sources and provide the animals with a balanced ration during the periods of forage scarcity.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCE

1. Alli-Balogun and Nwanta JK. Comparative evaluation of some crop residues on rabbit performance. Sokoto Journal of Vet. Sci. 2003;5(2):7-9

2. Adu IF, Taiwo BB, Buvanenaram V. The nutritive value and utilization of three tropical grass hay by sheep. Tropical grassland. 1992;16:29-32.
3. Conrad HR, Hibbs JW. Nitrogen utilization by ruminants. Journal of Dairy Science. 1988;51:276 – 284.
4. McDonald P, Edwards RA, Greenhaugh, JFD, Morgan CA, Sinclair BA, Wilkinson R. G. Animal Nutrition. Pearson pub. Co. UK. 2010;714.
5. AOAC. Official Methods of Analysis. 13th Edition. Association of Official Analytical Chemists, Washington DC; 2002.
6. Van Soest PJ, Robertson JB, Lewis BA. Methods for dietary fiber, neutral detergent fiber, and nonstarch polysaccharides in relation to animal nutrition. Journal of Dairy Science. 1994;74:3583–3597
7. Aduku AO. Tropical feedstuff analysis table. Department of Animal Science, Faculty of Agriculture. Ahmadu Bello University, Zaria; 2005.
8. Gatenby RM. Sheep. Revised edition. Tropical agriculturalist Series. MacMillan Publishers, New York. 2002;8-9.
9. Yusuf AM, Olafadehan OA, Obuh CO, Inuwa M, Garba MH, Shagwa SM. Nutritional evaluation of shear butter fat in fattening of Yankasa sheep. Pakistan Journal of Nutrition. 2009;8(7):1062-1067.
10. Gabriel OS, Fajemisin AN. Effect of urea-molasses multinutrients block supplementation on nutrients, anti-nutrients intake and weight gain WAD goats fed cassava peels. Journal of Animal Production Research. 2019;31(1):128–138.
11. Aye PA, Adigun MK. Digestibility and growth in West African dwarf sheep fed gliricidia-based multinutrient block supplements. Journal of Environmental Issues and Agriculture in Developing Countries. 2010;2(2 & 3):54-56.
12. Ali A. Performance of lambs fed urea-molasses blocks vs. concentrate. Journal of Animal Science. 1992’12:28 – 32.

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/75548