

Original Research Article

UTILIZATION OF UREA TREATED FIBROUS CROP RESIDUES BY YANKASA RAMS: EFFECT ON DRY MATTER INTAKE, PERFORMANCE AND NUTRIENTS DIGESTIBILITY

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-treated fibrous crop residues. Twenty (20) *Yankasa* rams weighing 15.0kg on average were allocated to four treatment diets which contained 0% (T1), 0.1% (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

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 requirements. The availability of these forages is mainly determined by the amount of rainfall and length of dry season. Sheep therefore gain feed on adequate quantities of herbage during the months of the wet season and consequently gain weight. 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 by [1]. This is because these animals can use fibrous feed to generate nutrients for maintenance and small level of production.

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

Most farm waste 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-treated farm waste by Yankasa sheep.

MATERIALS AND METHOD

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.

Experimental Animals and Their Management

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

After prior to their introduction to the experimental pens, 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 *adlibitum*, left overs were collected daily and weighed.

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)

Data Collection and Statistical Analysis

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

The average daily feed intake per animal was calculated as:

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

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:

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

Digestibility Trial: the last 14 days of the feeding trial was used for digestibility. The rams were transferred to metabolic cages and allowed 7 days 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 H₂SO₄ 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 formula:

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

Laboratory Analysis

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

Ingredients	Experimental Diets			
	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)

RESULTS AND DISCUSSION

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 9-14% [7] for sheep, and 10 – 12% [8] for ruminants. 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 very good as it was high in hemicellulose and NDF and within proportion that can be utilized by ruminants [9]

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

Proximate Composition (%)	Experimental Diets			
	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

Performance of Yankasa Rams fed urea treated fibrous crop residues

Table 3 presents the results of performance of Yankasa rams fed urea treated fibrous crop residues. 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 by 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 3. Performance of Yankasa Rams fed urea treated fibrous crop residues

Parameter	Experimental diets				SD	P-Value
	T1	T2	T3	T4		
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	0.120
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	0.21
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.

Nutrients and fibre fractions digestibility of Yankasa Rams fed urea treated fibrous crop residues

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. Dry matter (DM) digestible was not significantly different ($p > 0.05$) across the dietary treatments. The values ranged from 84.72% (T2) to 88.78% (T4). The digestibility of all nutrients and fibre fractions were significantly improved ($p < 0.05$) by urea treatment. Rams in T4 had significantly ($p < 0.05$) higher values than the others. This is an indication that treating crop residues with urea at 2% could optimize nutrient utilization by rams. This finding supports the report of [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 by [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% reported by [10] when goats were fed cassava peels with urea-molasses multinutrients 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]

Table 4. Nutrients and fibre fractions digestibility of Yankasa Rams fed urea treated fibrous crop residues

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

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.

CONCLUSION

Results obtained from this study reveals that performance indices measured for Yankasa rams fed urea treated fibrous crop residues, compares with that from combination 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.

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