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Nutrient Digestibility of Fattening Rams Fed Graded Levels of Fore-Stomach Digesta and Rice Milling Waste Ensiled with Urea

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Abstract

This study was conducted to find out the nutrient digestibility and performance of Uda rams fed Fore-Stomach-digesta (FSD)ensiled with Urea and rice milling waste (RMW). Fifteen (15) entire male Uda rams were used. The experimental test ingredient was formulated by ensiling 50% FSD and 50% RMW with urea for three weeks. Five animals were allocated as replications to three experimental diets as treatments in this trial in graded levels at 0%, 10% and 20%. The experimental diets were formulated using 50% FSD plus 50% RMW ensiled with urea and fed to the animals. The experimental diets are complete diets containing 13.61% CP content. The result indicated no significant differences ($P>0.05$) in terms of all the nutrients intakes between treatment means. However, values on Ether Extract and ADL intakes differ significantly ($P<0.05$) between treatment means. The body weight gain is significantly ($P<0.05$) different with treatment B (4.60) whose value is also similar to the least treatment C (3.80). Also Average daily gain followed the same pattern with body weight gain. Also the values of nutrients digestibility did not differ significantly between each other.

Keywords: *Nutrient Digestibility, Uda rams, Fore-Stomach, Digesta, Rice Milling*

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Background to the Study

In Nigeria nutrition constitute the major production constraint of livestock during the long dry period of the year especially in the semi-arid zone of the country. Livestock's gain weights during the wet season, but lose a considerable amount of the weight gained during the subsequent dry season. This is due to the fact that during the dry season; good quality and quantity pasture are rarely available. As the dry season progresses, the pastures become rarely available, and where the pastures exist are often of very low quality (Steinbach, 1997).

As much as 15% of the animal body weight attained at the end of the previous rainy season could be lost during the following dry season (Ibeawuchi and Adamu, 1990). This problem is more acute in North-Western part of Nigeria, especially in the semi-arid zone where the bulk of the livestock are found. This necessitates the search for unconventional feed resources. This experiment was carried out to find out the performance of fattening sheep fed fore-stomach digesta ensiled with urea and rice milling waste.

Methodology

Experimental Animals and their Management

The rams were dewormed with Sambizole 11^{R} dewormer at the rate of 3mls/10kg live weight of the animal and sprayed against ectoparasites by use of Triatic^{R} and treated with Oxytetracycline HCL at the rate of 1ml/10kg live weight (a broad spectrum antibiotic) administered intramuscularly.

The weight of the animals was balanced for each treatment and thereafter allocated to three treatment diets with five replicates each. The rams were housed individually in a pen measuring 1m × 2m size.

Experimental Feed Preparation and Formulation

In this experiment the dried Fore-Stomach Digesta (FSD) was ensiled with urea and RMW in larger quantity, in a tank container of about 300 litres capacity. The experimental diets were formulated using 50% FSD plus 50% RMW ensiled with urea and fed to the animals. The combination was used due to the fact that the combination gave the best live weight gain during the growth trial. The experimental diets are complete diets containing 13.61% CP content (Table 1).

Experimental Design and Feeding Procedure

Randomised Complete Block Design (RCBD) was used in this experiment as outlined by Steel and Torrie (1980). The FSD mixture from all species of animals slaughtered at the abattoir was ensiled in large quantities and used to formulate a complete diet.

Five animals were allocated as replications to three experimental diets as treatments in this trial. Each animal was individually housed in a pen, which was disinfected. Each group of five animals was assigned to one of the experimental diets and fed *ad libitum* for 90 days. Also water was offered *ad libitum*. Prior to allocation to treatment diets the animals were balanced for weight so that each group/treatment will have the same weight.

Data Collection
The animals were weighed prior to the commencement of the experiment and subsequently on the same day of every week between 8-9 am after withdrawing feed for 14-16 hours, to avoid error due to gut fill (Muhammad, 2005). Daily record of both feed intake was taken throughout the 90 days of the feeding trial.

Digestibility Trial
At the end of the feeding trial, a digestibility trial was conducted. The animals were kept in the feeding pens and were fed the same experimental diets used in the feeding trial. The digestibility trial last for 21 days, in which harness bags were fitted after 7 days of adaptation period so as to make the animals adaptable to the harness bags, with the last 7 days for collection of faeces during which record of daily feed intake was also kept. Total faecal output from each animal was recorded daily and 5% of it was oven-dried at 80°C for dry matter determination and then stored for subsequent analyses.

Chemical Analysis
Samples of the thoroughly mixed representative of the concentrate diet and faeces were analyzed for proximate composition (AOAC, 1990), fibre fraction analysis (ADF, NDF, ADL, Cellulose and Hemicellulose) (Van Soest*et al.,* 1991; Goering and Van Soest, 1970).

Statistical Analysis
The data generated from the experiment was subjected to analysis of variance (ANOVA) using CRD design according to Steel and Torrie (1980). Where significant differences between the means were indicated, Duncan's Multiple Range Test (DMRT) was used to separate the means (Duncan, 1955).

Table 1: Composition of the Experimental Diets

Ingredients	A (0%)	B (10%)	C (20%)
50% FSD + 50% RMW + Urea Ensiled	0	10	20
Groundnut Hay	30	20	10
Maize	19	19	19
Wheat Offal	25	25	25
Cowpea husk	25	25	25
Salt	1.00	1.00	1.00
Total	100	100	100
Calculated CP	13.19	13.19	13.19
Cost/kg Diet (N/Kg Diet)	56.11	53.11	50.11

Results

Chemical Composition of the Experimental Diets

Table 2: Chemical Composition of the Experimental Diets

Variables	Treatments			FSD
	A (0%)	B (10 %)	C (20 %)	
Dry matter (DM)	96.00	93.50	94.00	90.00
Crude protein (CP)	14.02	13.90	13.65	12.20
Crude fibre (CF)	29.52	28.00	29.59	28.70
Ether extract (EE)	8.12	7.71	7.51	3.10
Ash	12.33	10.61	11.48	28.10
Nitrogen free extract (NFE)	40.80	43.01	36.30	33.10
ME (Kcal/kg)	2624.86	2665.67	2402.01	-`
Neutral Detergent Fibre (NDF)	60.23	59.12	61.00	67.88
Acid Detergent Fibre (ADF)	41.90	39.00	47.21	43.32
Acid Detergent Lignin (ADL)	15.22	17.00	16.91	12.49
Cellulose	26.68	22.00	24.30	30.83
Hemi-cellulose	18.33	20.12	19.79	24.56

The DM contents of the experimental diets (Table 2) recorded highest in treatment A (96.00) followed by treatment C (94.00) then B (93.50). Crude protein content also recorded highest in treatment A (14.02) but the least was in C (13.65). Crude fibre content was highest in treatment C (29.59%) followed by treatment A (29.52%) and the least was obtained in treatments B (28.00%).

The Neutral Detergent Fibre (NDF) recorded highest value in treatment C (61.00%) followed by treatment A (60.23%) and the least value was in treatment B (59.12%). Acid Detergent Lignin ADL value was highest values in treatment B (17.00%) and the least value was in treatment A (15.22%). The Hemicellulose content recorded highest value in treatment B (20.12%) and the least value was obtained in treatment A (18.33%).

Table 3: Nutrients intake of fattening Uda rams fed Fore-Stomach Digesta (FSD) ensiled with Urea and Rice Milling Waste (RMW)

Variables	Treatments (Fore-Stomach Digesta Inclusion levels %)			
	A (0%)	B (10 %)	C (20 %)	SE
Feed intake (g/day)	1107.14	1094.27	1158.57	56.12
Dry matter intake (g/day)	1062.86	1028.63	1089.06	53.04
Organic matter intake (OM I)	905.22	848.62	899.56	44.15
Crude protein intake (CP I)	148.80	142.98	149.20	7.36
Crude fibre intake (CF I)	303.98	293.16	315.83	15.20
Ether Extract intake (EE I)	78.6[a]	66.86[b]	65.34[b]	3.50
NFE intake (g/day)	420.89	412.48	434.53	21.17
Ash intake (g/day)	114.79	113.15	124.15	17.59
NDF intake (g/day)	718.49	676.84	702.44	34.97
ADF intake (g/day)	512.29	474.20	497.70	24.69
ADL intake (g/day)	140.30[a]	129.61[ab]	118.71[b]	6.52
Cellulose intake (g/day)	371.99	339.45	378.99	18.05
Hemi-cellulose intake (g/day)	206.19	202.64	204.74	10.28

"ABC" means in the same row with different superscripts are significantly different (P<0.05)

Nutrients Intake of Fattening Uda Rams

The result on Table 3 indicated no significant differences (P>0.05) in terms of feed intake, Dry matter intake, Organic matter intake, Crude Protein Intake, Crude fibre intake, Nitrogen Free Extract, Ash intake, NDF intake, ADF intake, Cellulose and Hemicellulose intakes between treatment means. However, values on Ether Extract differ significantly (P<0.05) between treatment means, with treatment A (78.6g/day) giving the highest value followed by those in treatments B and C whose values did not differ significantly (P>0.05) between each other. ADL intake values are significantly (P<0.05) different. Treatment A (140.30) significantly higher and similar to treatment B (129.61) whose value is also similar the least value treatment C (118.71)

Table 4: Live weight gain and cost of production of fattening rams Fed Fore-Stomach-Digesta (FSD) ensiled with Urea and Rice Milling Waste (RMW)

Variables	Treatments (Fore-Stomach Digesta Inclusion levels %)			
	A (0%)	B (10 %)	C (20 %)	SE
Initial body weight (kg)	27.20	27.60	27.20	2.33
Final body weight (kg)	33.80	32.20	31.00	2.17
Body weight (kg)	6.60[a]	4.60[ab]	3.80[b]	0.85
Average daily gain (g/day)	78.57[a]	54.76[ab]	45.24[b]	10.12
Feed gain ratio	18.35	21.96	27.40	6.06
DMI as % body weight	3.17	3.22	3.56	0.15
Protein efficiency ratio	0.53	0.39	0.31	0.22
Cost of feed (N/kg)	56.11	53.11	50.11	-
Cost of feed consumed (N/kg)	59.64	54.63	54.57	2.82
Cost of feed/kg LWG (N/kg)	1142.09	1254.23	1424.96	414.67

"ABC" means in the same row with different superscripts are significantly different (P<0.05)

Live weight changes and cost of production

Live weight gains and cost of production of fattening uda rams is presented in table 4. The body weight gain is significantly ($P<0.05$) different with treatment B (4.60) whose value is also similar to the least treatment C (3.80). Also Average daily gain followed the same pattern with body weight gain. The least value was recorded in treatment A (21.96). Dry matter intake as percentage body weight although not significant recorded highest in treatment C (3.56) compared to the other treatments A (3.17) and B (3.22). Protein efficiency ratio was also not significant ($P>0.05$). Treatment A (0.53) recorded the highest closely followed by treatment B (0.39) then the lowest which is treatment C (0.31).

The cost of feed consumed recorded the lowest value in treatment C (54.57) and the highest value was in treatment A (59.64) followed by treatment B (54.63). Cost of feed consumed/kg live weight recorded highest value in treatment C (14.96) compared to treatment B (125.23) and the least value was treatment A (1142.09).

Table 5: Nutrient Digestibility of rams fed Fore-Stomach-Digesta (FSD) ensiled with Urea and Rice Milling Waste (RMW)

Variables	Treatments (FSD Inclusion levels %)			
	A (0%)	B (10 %)	C (20 %)	SE
Dry Matter	87.04	88.52	87.69	3.82
Crude Protein	90.75	90.72	83.86	3.85
Crude Fibre	85.42	87.33	86.17	4.27
Ether Extract	84.45	86.11	83.87	4.74
Nitrogen Free Extract	85.47	86.17	87.52	4.22
ASH	84.02	88.28	86.66	4.28
Neutral Detergent Fibre	86.90	88.44	86.92	3.99
Acid Detergent Fibre	87.77	89.09	87.59	3.69
Acid Detergent Lignin	83.68	82.60	77.70	5.18
Cellulose	89.31	92.05	90.46	2.89
Hemicellulose	86.66	86.91	86.02	4.19

Nutrients Digestibility of rams fed varying levels of Fore-stomach-Digesta ensiled with Urea and Rice Milling Waste (RMW)

From the table above values of nutrients digestibility (Table 5) did not differ significantly between each other in terms of dry matter digestibility, Crude protein digestibility, Crude fibre digestibility, ether extract digestibility, Nitrogen free extract digestibility and Ash digestibility. Also there were no significant differences in terms of NDF digestibility, ADF digestibility, ADL digestibility, Cellulose digestibility and Hemi-cellulose digestibility.

Discussion

Chemical Composition of the Experimental Diets

Dry Matter content of the experimental diets reduced from treatment A (96.0%) which is the control as ensiled FSD with RMW was added into the diets B (93.50%) and C (94.00%). The

crude protein levels in the present study were higher than 8.03-9.18 reported by Maigandi*et al*. (2004) when the authors ensiled Fore-Stomach-Digesta without urea. Also the crude protein levels of 14.02-13.65 were higher than the recommended level of 11% CP requirement of fattening rams weighing 30-55kg (Church, 1978). The higher CP may be due to the use of urea and process of ensiling which are said to improve CP contents in feeds (Chivandi*et al*., 2007; McDonald *et al*., 1995).

The crude fibre levels in the present study were lower than those values reported by Tukur and Maigandi (2010) when the authors fed varying levels of Fore-Stomach-Digesta in fattening rams. The higher CF value obtained may be efficient as the animals are matured and assumed to have sufficient micro-organisms for efficient degradation of fibre (McDonald *et al*., 2005). Also crude fibre values in the present study were higher than those values reported by Mohammed *et al.* (2012) when the authors fed poultry litter waste and Fore-Stomach-Digesta to Sahelian White goats.

Ether extract in the present study were higher than 1.92-6.80 values reported by Aliyu*et al.* (2012). The higher EE (7.51-8.12) content is probably one of the contributing factor for the lower performance of the animals as only about 5-6% is recommended for ruminant animals (Maithison*et al.,* 1997). EE is the reflection of fat content of a diet. Nitrogen free extract values of 45.9-47.4 reported by Aliyu*et al.* (2012) were higher than those obtained in the present study when the authors fed urea, poultry droppings and or urea treated *Pennisetumpedicellatum* to Yankasa Ram Lambs.

The values of acid detergent fibre obtained in the present study (39.00 – 41.90) were lower than the values of (51.3 – 77.8) obtained by Mohammed*et al*. (2012). Acid detergent Lignin in the present study were higher than the average value obtained by Rezakhani*et al*. (2008) when the authors determined the nutritive value of dried rumen contents. This might be due to the treatment of FSD with urea as it helps in the proliferation of rumen microorganisms which can infiltrate fibrous structures of forages and secrete enzymes that can break down the surrounding fibre (Chesworth, 1992).

Growth Performance and Cost of Production

Average Daily Gain (ADG) in the present study decreases (78.57 – 45.24) as ensiled FSD with urea and RMW were added into the diet. The performance of the animals was negatively affected in terms of growth as FSD increases in the diet. This is an indication that the diets are not suitable for fattening rams. The values were lower than those values (99.71 – 202.43) reported by Tukur and Maigandi (2010) when the authors fed varying levels of FSD in fattening rams. Although the ADG were low compared to the other studies (Tukur and Maigandi, 2010) there was an increase in body weight gain in all the treatments. This may be due to nutrients profile in the feeds (Yousuf and Adeloye, 2011). Feed Gain Ratio in the present study increases as level of ensiled FSD with urea and RMW was added into the diets while protein efficiency ratio decreases as level of ensiled FSD with urea and RMW was included. Cost of feed (N/kg) and cost of feed consumed (N/kg) reduces as the level of ensiled FSD with urea and RMW was included into the diets of the present studies, while cost of

feed/kg LWG (N/kg) increases from (1142.09 – 1424.96) as the level of ensiled FSD with urea and RMW was incorporated into the diets. The cost of feed/kg LWG (N/kg) shows that the experimental diets could not be recommended to the farmers, even though the cost of feed consumed decrease as the level of FSD increases but the weight gain is seriously affected as indicated from the result.

Nutrients intake by Fattening Uda Rams

Feed intake and dry matter intake were highest in treatment C with 20% FSD inclusion level, although the lowest BWG and ADG were obtained in this treatment. The higher feed intake and dry matter intake may be attributed to higher percentage of ensiled FSD with urea and RMW as reported by Joy *et al.*(1992); Fahmy and Klopfenstein(1994); Schiere and de Wit(1995) that increased forage intake due to urea treatment was noticed. Dry matter intake of 1089.06 – 1028.63 obtained in the present study were lower than the values of 1817.0 – 1324.70 obtained by Tukur and Maigandi (2010) when FSD was fed at varying levels in fattening rams.

In this study crude protein intake (CPI) and crude fibre intake (CFI) were also higher in treatments C although this treatment had the lowest ADG, there is increase in body weight. Also the values of CPI and CFI obtained here were lower than those obtained by Tukur and Maigandi (2010).

Neutral Detergent Fibre and Acid Detergent Fibre intakes decreased as FSD ensile with urea and RMW was added into diet but slightly increase when the level was increased to 20% in treatment C. Acid detergent lignin intake decreases from 140.30 – 118.71 as FSD ensiled with urea and RMW were incorporated into the diets.

Nutrients Digestibility of Fattening Rams

Nutrients digestibility in the present study was generally high. Dry matter digestibility in the present study 88.52 – 87.04 were higher than those values of 67.75 – 84.26 reported by Tukur and Maigandi (2010). Also the crude protein decrease as FSD ensiled with urea and RMW were added to the diets although not significantly different, but still crude protein digestibility was higher than those reported by Tukur and Maigandi (2010) when the authors fed FSD at varying levels in fattening rams.

NDF digestibility in the present study 86.90 – 88.44 was higher the those values of 64.2 – 69.7 reported by Brown and Adjei (1995) when the authors fed urea ammoniated guinea grass hay to sheep. Generally, the higher digestibilities in the present study may be due to a better ruminant environment created by an increased microbial population, slow release of ammonia and sufficient production of volatile fatty acids (McDonald *et al.,* 1995; Sarwar*et al.,* 2004; Nisa*et al.,* 2004).

Conclusion

Conclusively the general trend of the results indicated that FSD and RMW could be used for fattening in the diets of ruminant animals, especially in the dry season.

Recommendation

Ensiled FSD, RMW and Urea combinations could be used in the diets of ruminants. Also other feed ingredients should be used to improve the feeding value of FSD and RMW for better weight gains. FSD and RMW could be used as main ingredients in the formulation of commercial fattening diets.

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