Chemical composition of Camel Fore-Stomach Digesta (FSD) ensiled with urea and graded levels of Rice milling Waste (RMW)

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Abstract- This study was conducted to determine the chemical composition and fibre fractions of Fore-Stomach-digesta (FSD) ensiled with Urea and rice milling waste (RMW) and also its effect on the performance of Uda sheep. Fore-Stomach Digesta (FSD) from camel were collected at the Sokoto abattoir. Samples were thoroughly mixed and representative samples were collected and ensiled for a period of three weeks. The ensiled materials are 100% FSD ensiled with urea designated as treatment A, 75% FSD and 25% Rice Milling Waste (RMW) ensiled with urea designated as treatment B, 50% FSD and 50% RMW ensiled with urea designated as treatment C while 50% FSD and 50% RMW treated with urea but not ensiled designated as treatment D. The results showed that there were no significant variations (p>0.05) between treatments in terms of Dry Matter (DM) content. Crude Protein (CP) content was significantly different (p<0.05) between treatment means with treatment D (19.04%) having higher value and B (17.05%) having the least. there were no significant variations (p>0.05) between treatments in terms of Dry Matter (DM) content. Crude Protein (CP) content was significantly different (p<0.05) between treatment means with treatment D (19.04%) having higher value and B (17.05%) having the least The Nitrogen Detergent Fibre (NDF) was significantly higher (P<0.05) in treatment D (71.83%) and the lowest value was obtained in treatment B (63.67%) while treatments A (67.70%) and C (68.23%) values were similar. There were significantly (P<0.05) lower and similar values in treatments C and D of both Calcium and phosphorous contents. Treatments A recorded significantly (P<0.05) higher value followed by treatments B. The higher CP content in the present study might be due to the addition of urea, as urea adds nitrogen to feed material and therefore increase crude protein content.

Index Terms- Fore-Stomach Digesta (FSD), Urea, Ensiling, Chemical Composition

I. Introduction

Under dry conditions feed availability is an important issue for resource poor local farmers. Non-conventional feeds offer an option to overcome this and increase production and livestock survival rates. Fore-Stomach Digesta (FSD) is an abattoir waste product that can be obtained free of charge from most abattoirs in Nigeria. Due to lack of adequate waste disposal facilities, it is often found decaying in most abattoirs, (Maigandi and Tukur, 2002). Maigandi (2001) reported that FSD includes all the materials from the fore-stomach compartments of camel and ruminant animals after cleaning out their guts. FSD is made up of partially digested feed materials and rumen liquor which is partly contributed by the water intake, water in feed and large volume of water secreted (Kumar, 1989). The partially digested feed residue of FSD may be considerably influenced by the type of diet and time interval between feeding and slaughtering.

The chemical composition of FSD depends on the specie of animal, the type of feed consumed by the animal, the season of the year (Alhassan, 1985), the time of sampling from the animal (Riveira, 1977) and the type of treatment given to the FSD prior to analysis (Kumar, 1989).

Therefore the utilization of FSD as feed ingredient will provide a means of its disposal and lowering feed cost (Maigandi and Tukur, 2002). There is also the need to improve its quality.

Rice milling waste (RMW) is an agro-industrial by-product found in large quantities in areas where rice is produced abundantly and it is a potentially useful component of concentrate portion of diets for ruminants (Alawa and Umunna, 1993).

Urea as the commonest source of degradable nitrogen for inclusion in diets of ruminants and also can provide a substantial amount of the supplemental Nitrogen (N) required where livestock management is good and feed is formulated and mixed properly.

As Fore-Stomach-Digesta (FSD) cannot be fed alone to animals, it is necessary to improve it through some means (Anthony, 1971). Ensiling is one of the ways of improving and preserving the value of feeds for ruminant animals (McDonald *et al.*, 1995; Maigandi *et al*., 2004), therefore these methods can be used to improve and preserve Fore-Stomach-Digesta (FSD) for better utilization by ruminants.

II. Methodology

Sample collection and Preparation

Fore-Stomach Digesta (FSD) from camels was collected at Sokoto abattoir. At least 5-10 animals that were brought to the abattoir for slaughter were selected for the collection. After slaughter and evisceration at least 0.5kg of the fresh FSD was collected. Samples were thoroughly mixed and representative samples were collected. The representative samples collected were immediately transferred to an air-tight container and transported to the experimental site. Urea and Rice Milling Waste (RMW) were purchased from Sokoto central market and

Kalambaina rice processing centre in Sokoto respectively. The samples were ensiled for 21days in triplicate.

Experimental Design and Ensiling Procedure

A factorial design in CRD (Steel and Torrie, 1980) was used in this experiment, with three replications of fore-stomach digesta (FSD) from camel. The factor was the inclusion of RMW at graded levels in the FSD as indicated in table 1. The samples were thoroughly mixed and ensiled for a period of three weeks.

Table 1: Gross composition of the Ensiled Camel FSD with Urea and RMW

	Inclusion Levels of Camel Fore Stomach Digesta			
	100 (A)	75(B)	50(C)	50(D)*
Rice Milling Wastes	0	25	50	50*

1kg of Urea plus 25kg of the diet in all the treatments **Unensiled samples*

Twelve (12) bottles of 946ml capacity were used as laboratory silos (Ogunlolu *et al.*, 2010). The procedure of Roy and Rangnekar (2006) was followed in which 1kg urea was dissolved in 15 litres of water and sprinkled on 25kg FSD. The samples were ensiled for 21days in triplicate. Masking tape was used to further seal the bottles after filling weighed materials and compressed. The ensiled materials are 100% FSD ensiled with urea designated as treatment A, 75% FSD and 25% Rice Milling Waste (RMW) ensiled with urea designated as treatment B, 50% FSD and 50% RMW ensiled with urea designated as treatment C while 50% FSD and 50% RMW treated with urea but not ensiled designated as treatment D.

Chemical Analysis

After three weeks, the 12 ensiled samples were opened and collected for analysis. The samples were analysed for proximate composition using AOAC (1990) procedures and for fibre fractions (ADF, NDF, ADL, cellulose and hemicellulose) using Goering and van Soest (1970) and van Soest *et al*. (1991) procedures. The samples were analysed for mineral composition according to the procedures of AOAC (1990). Potassium (K) and Sodium (Na) were analysed using Flame photometer, while Atomic Absorption Spectrophotometer (AAS) was used to analyse the samples for Calcium (Ca) and Magnesium (Mg) contents. Energy was calculated from the formula: 37 X %CP + 81 X %EE + 35.5 X % NFE (Pauzenga, 1985).

Statistical Analysis

Data collected from the proximate, fibre fractions and mineral analyses were analysed using analysis of variance (ANOVA) and treatment means were compared using the Least Significant Difference test (LSD) (Steel and Torrie, 1980).

III. Results

Chemical Composition of Camel Fore-Stomach Digesta ensiled with Urea and Rice Milling Waste slaughtered at Sokoto Abattoir

From table 2 it could be observed that there were no significant variations (p>0.05) between treatments in terms of Dry Matter (DM) content. Crude Protein (CP) content was significantly different (p<0.05) between treatment means with treatment D (19.04%) having higher value and B (17.05%) having the least. NFE Nitrogen Free Extract content recorded significantly higher (p<0.05) value in treatments A (32.08%), B (33.74%) and C (34.13%) whose values did not differ significantly (p>0.05) between each other. The lowest NFE was obtained in treatment D (30.58%).

The Nitrogen Detergent Fibre (NDF) was significantly higher (P<0.05) in treatment D (71.83%) and the lowest value was obtained in treatment B (63.67%) while treatments A (67.70%) and C (68.23%) values were similar. The Acid Detergent Fibre (ADF) was also significantly higher (P<0.05) in treatment D (44.87%) followed by treatment C (43.17%) and then treatments A (41.47%) and B (42.00%) were similar. Acid Detergent Lignin (ADL) was significantly higher in treatment D (14.50%) but differed significantly with the treatments A (12.23%) and B (13.00%) whose values were similar. The lowest value was in treatment C (11.20%). The Cellulose content was significantly higher (P<0.05) in treatment C (31.97%) compared to the other treatments, but also treatments A (29.00%) and B (29.00%) were significantly (P<0.05) the same. Hemi-cellulose was significantly higher (P<0.05) and similar in treatments A (26.23%), C (25.07%) and D (26.97%), while treatment B (21.67%) was significantly (P<0.05) different and also the lowest.

Table 2: Chemical Composition of Camel Fore-Stomach Digesta (FSD) ensiled with urea and graded levels of Rice Milling Waste (RMW)

Variables (%)	Inclusion Levels of FSD (%)				SEM
	A (100)	B (75)	C (50)	D (50*)	
Dry Matter	89.64	89.60	89.50	90.00	0.21
Organic Matter	76.40^{b}	76.39^{b}	77.14^{ab}	77.27^{a}	0.28
Crude Protein	17.55^{c}	17.05^{d}	18.48^{b}	19.04^{a}	0.12
Crude Fibre	28.93	29.83	29.53	29.37	0.26
Ether Extract	8.30^{a}	6.16^{b}	5.50^{c}	8.27^{a}	0.18

Nitrogen Free Extract	32.08^{ab}	33.74^{a}	34.13^{a}	30.58^{b}	0.42
Ash	13.24^{a}	13.21^{a}	12.36^{c}	12.73^{b}	0.14
**ME (kcal/kg)	2460.49	2327.58	2340.87	2459.94	
Neutral Detergent Fibre (NDF)	67.70^{b}	63.67^{c}	68.23^{b}	71.83^{a}	0.40
Acid Detergent Fibre (ADF)	41.47^{c}	42.00^{c}	43.17^{b}	44.87^{a}	0.15
Acid Detergent Lignin (ADL)	12.47^{b}	13.00^{b}	11.20^{c}	14.50^{a}	0.26
Cellulose	29.00^{c}	29.00^{c}	31.97^{a}	30.37^{b}	0.26
Hemi-cellulose	26.23^{a}	21.67^{b}	25.07^{a}	26.97^{a}	0.37

Means on the same row with different superscripts are significantly different ($P<0.05$)
**Unensiled samples*

Table 3 indicates Mineral Composition of Camel Fore-Stomach Digesta (FSD) ensiled with urea and graded levels of Rice milling Waste (RMW). There were significantly ($P<0.05$) lower and similar values in treatments C and D of both Calcium and phosphorous contents. Treatments A recorded significantly ($P<0.05$) higher value followed by treatments B. In the Potassium content there was significantly higher ($P<0.05$) value in treatment A (52.6%) and the lowest value in treatment C (45.2%). Magnesium content was also significantly higher ($P<0.05$) in treatment A (5.7%) compared to the other treatments. Also treatments C (3.3%) and D (3.4%) were similar. The Cobalt content recorded significantly ($P<0.05$) higher and similar values in treatments A (0.4%) and B (0.4%) compared to treatments C (0.3%) and D (0.3%) whose values were also similar.

Table 3: Mineral Composition of Camel Fore-Stomach Digesta (FSD) ensiled with urea and graded levels of Rice milling Waste (RMW)

	Inclusion Levels of FSD (%)				SEM
Variables(%)	(A)100	(B)75	(C)50	(D)50*	
Calcium (Ca)	7.9^{a}	6.6^{b}	5.3^{c}	5.6^{c}	0.01
Phosphorous (P)	5.3^{a}	4.3^{b}	3.9^{c}	3.8^{c}	0.01
Potassium (K)	52.6^{a}	46.5^{c}	45.2^{b}	50.4^{b}	0.02
Magnesium (Mg)	5.7^{a}	4.5^{b}	3.3^{c}	3.4^{c}	0.01
Cobalt (Co)	0.4^{a}	0.4^{a}	0.3^{b}	0.3^{b}	0.08

*Unensiled samples

IV. DISCUSSION

Chemical composition of the Camel's Fore-Stomach Digesta (FSD) ensiled with urea and graded levels of Rice milling Waste (RMW)

Dry Matter (DM) values of FSD from camel were higher in the treatment where FSD, Urea and RMW were not ensiled (treatment D) compared to those that were ensiled (treatments A, B and C). This might be due to the microbial activity as a result of ensiling FSD prior to the analyses (Kumar, 1989). The DM values obtained in this study were higher than those values (13-20%) obtained by Maigandi and Tukur (2002) and 14% obtained by Kumar (1989) when FSD was analysed alone. This might be due to the fact that ensiling improves value of feeds for ruminants (Mcdonald *et.al,* 1995 and Maigandi *et.al,* 2004).

The CP contents obtained from the present study where the FSD was ensiled for three weeks period were higher than those obtained by Maigandi *et.al* (2004) when FSD was ensiled at 2, 4 and 6 weeks period. This rejects the idea that there was progressive decrease in the CP due to tilt in the balance from true protein to Non Protein Nitrogen (NPN) due to enzymatic changes as the period of ensiling increases. Also there were higher CP values in the FSD from camel compared to those of Maigandi and Tukur (2002) and 12.04% for cowpea husk (Adeloye, 1994) as well as 2.4-6.4% obtained from cereal crop residues (Alawa and Umunna, 1993). The higher CP content in the present study might be due to the addition of urea, as urea adds nitrogen to feed material (Ben Salem and Smith, 2008) and therefore increase crude protein content.

In the present study CP and DM values of camel were lower than those reported by Maigandi *et al.* (2008) when FSD was ensiled with poultry waste. This might be due to differences in ensiling materials used and proportion of FSD and other ingredients used (Maigandi *et al.*, 2008; Alhassan, 1985).

The Organic Matter contents of FSD from camel in the present study were lower than 90.99 for hay, 93.01 for wheat bran and 93.00 for corn stalk (Elkholy *et al.*, 2009). Also the OM values of unensiled sample in the overall study were higher than the ensiled samples. This might be due to the fact that the longer period of ensiling reduces the moisture content of FSD and increases the DM (Maigandi *et al*, 2008; Jakmola *et al*, 1984).

The CF contents of FSD obtained in this study are lower than those obtained by Weixian (1995) when wheat straw was treated with urea and ammonia, but were similar to those obtained by Boda (1990) and Maigandi *et al.* (2004), but were higher than those values when FSD was ensiled with poultry waste (Maigandi *et al.*, 2008).

In the overall study EE was highest in the 100% camel FSD (i.e 100% FSD ensiled with urea). This might be as a result of the fact that camels are said to produce higher amounts of volatile fatty acids in their fore-stomach compared to other ruminants (Jouany *et al*, 1995).

The NDF contents of the diet show that unensiled materials contained more NDF which is an indication that it is bulkier than the ensiled materials. This clearly indicates that ensiling process had an effect on size particles of the experimental materials. This result could be predicted to means that unensiled feed materials in this experiment requires more chewing so as to reduce particle size (Varga *et al;* 1998). It means that when this diet is use in feeding animals there would be more regurgitation activities compared to the diets from other treatments.

Also the NDF and ADF content in this study were lower than those reported by Weixian (1995) when straw was treated with anhydrous ammonia and urea. The lower NDF in the present study might be due to the report that urea treatment reduced NDF concentration by solubilization of hemi-cellulose and/or ADL fractions (Gibb and Baker., 1989; Schiere and de Wit, 1995). But NDF and ADF fell within the range of values for roughaghes reported by (NRC, 1985) in the table of nutrients composition. Also NRC (1989), recommended 25-28% and 19-21% for NDF and ADF respectively.

Higher NDF in the diet require more chewing, as NDF represents structural carbohydrate components of feed that commonly require chewing activity for particle size reduction and passage. The higher NDF in the present study increases the regurgitation activity in the animals which is one of the important characteristics in ruminants (Varga *et al.,* 1989).

Mineral Composition of Camel FSD Ensiled with Urea and Graded Levels of RMW

The calcium content in this study is similar to those reported by Maigandi and Owanikin (2002). The calcium: phosphorous ratio in the camel FSD in this study are in line with what was reported by McDonald *et al.* (1995) that the calcium: phosphorous ratio considered most suitable for farm animals is within the range of 1:1-2:1, although there is evidence which suggests that ruminants can tolerate higher ratios provided the phosphorous requirements are met. The mineral composition contents recorded highest values in the 100% FSD ensiled with urea only (treatments A).

The cobalt content was within the normal range of 0.02-0.04 mg/kg as deficiency symptoms are said to occur where levels of cobalt in the herbage are below 0.1 mg/kg DM.

CONCLUSION

his study concludes that Dry matter, Crude protein and Crude fibre contents were improved by ensiling Fore-Stomach Digesta (FSD) with Urea and Rice Milling Waste (RMW) and can be used as feed for ruminants.

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