# EVALUATION OF ENSILED FORE STOMACH DIGESTA (FSD) WITH COWPEA HAY ON THE PERFORMANCE OF FATTENING SHEEP IN A SEMI-ARID ENVIRONMENT

N. Muhammad
Department of Animal Science, Usmanu Danfodiyo University Sokoto, Nigeria

M.M Bello
Livestock development department, Ministry of livestock and fishery development, Sokoto state, Nigeria

S.A. Maigandi
Department of Animal Science, Usmanu Danfodiyo University Sokoto, Nigeria

A.A. Magaji
Faculty of Veterinary medicine, Usmanu Danfodiyo University Sokoto, Nigeria

M. G. garba
[3]Department of Animal Production and Health, Federal university, Dutsima, Katsina State, Nigeria

A. Yusuf
[3]Department of Animal Production and Health, Federal university, Dutsima, Katsina State, Nigeria

## ABSTRACT

The study was carried out in two phases at Usmanu Danfodiyo University Livestock Teaching and Research Farm Sokoto, to evaluate ensiled FSD with cowpea hay on the performance of fattening Uda sheep. In the first phase, silage was prepared in a period of 21 days from 70% FSD and 30% cowpea hay mixture at varying moisture levels (30, 40, 50 and 60% i.e. 30kg, 40kg, 50kg and 60kg water/ 100kg FSD-Cowpea hay mixture) designated as treatments A, B, C and D respectively. In the second phase, Eighty four (84) days feeding and Fourteen (14) days digestibility trials, was conducted using sixteen (16) fattening Uda rams in a completely randomized experimental design (CRD). The results indicated that pH content of the ensiled materials decreased from 4.75 (for treatment A) to 4.35 (for treatment D), while the colour (pale yellow) and aroma (sweet) remain the same for all the treatments after fermentation period of 21 days. Chemical composition of the ensiled material indicates that crude Protein (CP) content was lower (8.66%) for treatment A and higher (10.50%) for treatment D while Crude fiber (CF) content decreased from 27% for treatment A to 25% for treatment D. Total feed intake (TFI) and average daily gain (ADG), dry matter (DM) and crude protein (CP) digestibility of the animals slightly increased with increase in level of silage moisture up to 50% (50kg/100kg FSD), there after it declined ($P>0.05$). However, Cost of feed per kg live weight gain was lower for animals fed silage with highest moisture content (treatment D) ($P<0.05$). It was concluded that ensiling rumen content with cowpea hay at 60% moisture will significantly reduce cost of sheep production.

**Keywords:** Rumen content, Uda rams, acceptability.

## INTRODUCTION

Fore-stomach digesta (FSD) is a waste obtained freely from abattoirs in Nigeria. Due to lack of adequate disposal facilities, it is often left decaying producing repulsive odour providing suitable conditions for proliferation of pathogens and parasites. Its utilization as feed ingredient will provide an effective means of waste disposal, reducing environmental pollution in addition to reducing feed cost (Maigandi *et al.*, 2002).

Maigandi (2001) quantified and evaluate the chemical composition and acceptability of fore-stomach digesta (FSD) from camels, cattle, sheep and goats at Sokoto central abattoir. Tukur and Maigandi (2010) evaluated FSD on fattening rams showing incorporation level of up to 30% without adversely affecting performance.

Acceptability is the major feeding defect of FSD as animal feed (Kumar, 1989). The acceptability and feeding value of FDS could be enhanced by ensiling, a controlled microbial fermentation used to improve the feeding value of feed ingredients as reported by Gerald and Thomas (2006). Ensiling aids in masking odour of feed materials including FSD, as odour is one of the factors affecting its efficient utilization (Maigandi *et al.*, 2002). El-Yassin *et al*. (1991) showed a desirable aroma and improved nutrient content and feed acceptability by ensiling FSD and blood meal. El-Yassin *et al*. (1991) further indicated improved apparent digestibility in sheep fed ensiled mixture with treated straw.

Silage can be made from plant materials with suitable moisture content depending on the methods of storage, degree of compression and water content of feed materials (Ronald, 1994). Moisture plays a critical role in the success of fermentation. When it is too low, air can remain entrapped within the silage mass and encourages growth of spoilage organisms and when it is too high, run-off and spoilage become serious problems. Therefore, ensiling at the proper moisture creates suitable environment for lactic-acid producing bacteria to dominate and control the silage fermentation (Woolford, 2000). Ensiling therefore could only be successful with minimum dry matter (DM) and nutrient losses. This situation is only possible when the moisture content of the raw material is kept to a suitable level (Liu and Guo, 2012). This study was therefore designed to find out the effective moisture on the quality of silage from ensiled FSD and cowpea hay and its acceptability by Uda sheep.

## MATERIALS AND METHODS

### Experimental Location

The study was conducted at the Livestock Teaching and Research Farm, Usmanu Danfodiyo University, Sokoto. The farm is situated within the main campus of the University at about 10km North of Sokoto Metropolis in Wamakko Local Government Area of Sokoto State. Sokoto State is located in the Sudano-Sahelian zone in extreme North-western part of Nigeria. It falls between longitudes $4^{0}$8E and $6^{0}$ 54'E and latitudes $12^{0}$O'N and $13^{0}$58'N (Mamman *et al.*, 2000) and at an altitude of 350m above sea level.

Sokoto State has semi-arid climate, which is characterized by low rainfall in which the mean annual rainfall is about 500 - 1300mm although, rainfall vary in amount from year to year and strongly seasonal in incidence. Heat is more severe in the state in March and April, but the weather in the state is always cold in morning and hot in afternoons save in peak at harmattan period. Diurnal and seasonal temperature fluctuations are very wide, where minimum temperature has been recorded to be $13^{0}$ in January and maximum temperature of $44^{0}$C has been recorded in April (SSGD, 2002).

Sokoto has two main seasons, the dry season, which last from October to May/June and the rainy season that lasts from May to September/October. Sokoto State is part of the North Western Nigeria with abundant livestock resources. This is because the climate is more suitable for livestock production, due to absence of Tse- tse- fly on an open grass land (SSGD, 2002). There is all kind of animals in both wild and domesticated forms in the state.

Sokoto ranks second in livestock production in the country with animal population of over 8 million (SSGD, 2002).

**Experimental Feed Sourcing**

Fresh fore-stomach digesta (FSD) was collected from Sokoto central abattoir. The FSD was obtained from the livestock slaughtered at the abattoir irrespective of the species. The FSD was open air-dried by spreading it on tarpaulin sheets. The period of drying was about one week, depending on the intensity of sunshine. The sun-dried FSD was packed in sacks and stored. Other feed ingredients (indicated in table 1) were purchased from the Sokoto central Market. Maize was crushed before being incorporated into the diet. Cowpea hay was cut into pieces of about 5mm long, parked and stored.

**Experimental Diets Preparation**

The dried samples of FSD and cowpea hay were mixed in the ratio of 70% FSD and 30% cowpea hay for all the treatments whereas, water to be used in the mixture was varied at the following rates: Treatment A 30%, treatment B 40%, treatment C 50% and treatment D 60% moisture levels i.e. 30kg/mixture of FSD and cowpea hay, 40kg/mixture of FSD and cowpea hay, 50kg/mixture of FSD and cowpea hay and 60kg/mixture of FSD and cowpea hay respectively.

**Table 1: Composition of Supplementary Concentrate Diet**

| Ingredients | Composition (%) |
|---|---|
| Maize | 19 |
| Soya bean meal | 15 |
| Wheat offal | 35 |
| Cowpea husk | 30 |
| Salt | 1 |
| Total | 100 |
| **Calculated nutrient composition** | |
| Calculated crude protein (%) | 17.49 |
| Crude fiber (%) | 16.18 |
| Energy (kcal ME/kg) | 1616.46 |

**Determination of Silage Physical Characteristics**

Jars containing the samples of ensiled FSD and cowpea hay were kept at room condition for an incubation period of 21 days according to the method described by Wilhelm and Wurm (1999). Following the fermentation period, the contents of the jars was visually examined and scored for colour. Each jar was opened and the content scored for aroma. Subjective scores, on a scale of 1 to 4 are described in table 2. Thereafter, the pH of the Silage was determined, the silage was oven dried at $60^0$C for 2 days and preserved for chemical analysis.

**Table 2: Description of Colour and Aroma Scores Used for Assessing Silage**

| Score | Colour | Aroma |
|---|---|---|
| 1 | Dark/deep blue | Protrude or rancid |
| 2 | Light brown | Pleasant |
| 3 | Pale yellow | Sweet |
| 4 | Yellowish green | Very sweet |

Adopted from Kallah *et al.* (1997)

### Experimental Animals and their Management

Sixteen (16) intact Uda rams with an average live weight of 22.72kg, was purchased from village markets around Sokoto State for the experiment. The rams were transported to the experimental site and quarantined for two weeks, dewormed with Sambizole$^R$ dewormer at the rate 3mls/10kgLW and sprayed against ecto-parasites by the use of Triatic$^R$. The animals were treated with Oxytetracycline HCl (a broad spectrum antibiotic) at the rate of 1ml/10kgLW against possible bacterial infection. The animals were managed intensively and group fed with cowpea hay, wheat bran and cowpea husk prior to commencement of the experiment.

### Experimental Design and Dietary Treatments

A completely randomized experimental design (CRD) was used in the experiment. Different moisture levels of 30, 40, 50 and 60% to the ensiled materials serves as treatments (A, B, C and D respectively). In each treatment there were 4 animals, each animal serving as replicate. The animals were balanced for weight at the start of the experiment.

### Housing, Feeding and Data Collection

Each animal was housed in a pen measuring 1X2m which has been previously disinfected. Each group of the animals was assigned to one of the experimental diets as a basal diet, while concentrate was serve as supplement and fed at rate of 1% body weight which was adjusted on weekly basis. Feeding basal diet was *ad-libitum* in morning and evening for 84 days. Water was also offered *ad-libitum.*

All animals were weighed prior to the commencement of the experiment and subsequently on the same day of the week between 8 am and 9 am after feed withdrawal 14 - 16 hours to avoid error due to gut-fill. Daily record of feed and water intakes were taken throughout 84 days of the feeding trial.

### Digestibility Trial

At the end of the feeding trial, a digestibility study was conducted using three animals from each treatment. The animals were fed the same experimental diets used in the feeding trial. The trial lasted for 14 days (7 days for adaptation and 7 days for collection of faeces). Total faecal output from each animal was recorded daily and 5% of it was oven dried at $80^0$C for determination of dry matter and chemical composition.

### Chemical Analysis
### Determination of Proximate components

Thoroughly mixed representative samples of the four experimental diets, concentrate and faeces were analyzed for proximate composition as outlined by AOAC (1990).

### Fiber Fraction

Acid detergent fiber (ADF) and Neutral Detergent Fiber (NDF) were analysed in the sample as reported by Ranjhan and Krishna (1980).

**pH Determination**

The pH of the extracts, were determined electrometrically, according to procedure discussed by Barker and Summerson (1941).

**Moisture Content**

The amount of water to be added during ensiling was assessed using measuring scale as described by Mahanna (2005).

**Statistical Analysis**

The data generated from the experiment was statistically analysed using STATVIEW statistical package (SAS, 2012).

## RESULTS

### Physical Characteristics of ensiled fore-stomach Digesta (FSD) and Cowpea hay

The physical characteristics of ensiled FSD and cowpea hay are shown in table 3

**Table 3:** Physical Characteristics of Ensiled FSD and Cowpea Hay

| Parameter | Silage Moisture Inclusion levels (%) (kg) | | | |
|---|---|---|---|---|
| | A (30) | B (40) | C (50) | D(60) |
| Colour | Pale Yellow | Pale Yellow | Pale Yellow | Pale Yellow |
| Odour | Sweet | Sweet | Sweet | Sweet |
| pH | 4.75 | 4.60 | 4.45 | 4.35 |

The colour and taste of the ensiled FSD and cowpea hay were pale yellow and sweet aroma respectively. pH content decreased from 4.75 (treatment A) to 4.35 (treatment D).

### Chemical Composition of Experimental Diets

The chemical composition of the experimental diets and concentrate mixture are shown in Table 4.

**Table 4:** Proximate Composition of the Experimental Diet and Concentrate Mixture

| Parameters (%) | Silage moisture Inclusion levels (%) | | | | |
|---|---|---|---|---|---|
| | A(30) | B(40) | C(50) | D(60) | Concentrate |
| Dry matter | 94.10 | 93.00 | 95.20 | 96.00 | 98.10 |
| Crude protein | 8.66 | 9.45 | 9.89 | 10.5 | 15.93 |
| Crude fiber | 27.00 | 26.00 | 25.50 | 25.00 | 28.00 |
| Ether extract | 2.50 | 2.50 | 3.00 | 2.50 | 3.50 |
| Ash | 14.00 | 13.50 | 12.50 | 11.00 | 7.00 |
| Nitrogen free Ext. | 47.84 | 48.61 | 51.00 | 52.30 | 46.57 |
| NDF | 52.00 | 51.10 | 50.80 | 49.00 | 64.20 |
| ADF | 32.00 | 40.90 | 36.10 | 35.80 | 33.30 |

The dry matter (DM) content of the experimental diets ranged from 93.00% for treatment B and 96.06% for treatment D. Crude protein (CP) content was lower (8.66%) for treatment A and higher (10.50%) for treatment D, while crude fibre (CF) content decreased from 27% for treatment A to 25% for treatment D. Ether extract (EE) varied between 2.50% (treatment A, B, D) and 3.0% (treatment C).

For the Ash contents, there was regular pattern of variation. However, the highest value was obtained in treatment A (14%) and lowest in treatment D (11.0%). Nitrogen free extract (NFE) was highest in treatment D (52.30%) followed by treatment C (51%) and then treatment B (48.61%). The least value was obtained for treatment A (47.84%). Neutral detergent fiber (NDF decreased from 52% for treatment A to 49% for treatment D. Acid detergent fibre (ADF) was higher for treatment B (40.9%) and lower for treatment A (32%).

The concentrate contained 98% DM, 15.93% CP, 28% CF, 3.5% EE, 7% Ash, 46.57% NFE, 64.2% NDF and 33.3% ADF.

**Performance Characteristics by Uda Lambs Fed Ensiled Fore-Stomach Digesta (FSD) and Cowpea Hay**

Performance characteristics of Uda rams when fed experimental diets at different silage moisture levels was shown in table 5.

**Table 5:** Performance Characteristics of Uda Rams Fed Experimental Diets

| **PARAMETERS** | **TREATMENTS Silage moisture inclusion level** | | | | **SEM** |
|---|---|---|---|---|---|
| | A (30%) | B (40%) | C (50%) | D (60%) | |
| Initial BW (kg) | 22.75 | 22.25 | 22.75 | 22.63 | 1.54 |
| Final BW (kg) | 28.75 | 29.25 | 30.38 | 29.88 | 1.82 |
| Weight gain (kg) | 6.00 [b] | 6.50 [b] | 7.63 [a] | 7.25 [a] | 0.58 |
| ADG (g/day) | 71.43 [b] | 77.38 [b] | 90.77 [a] | 86.31 [a] | 6.91 |
| Water Intake L/day | 2.02 [b] | 2.30 [a] | 2.40 [a] | 2.23 [b] | 0.10 |
| DM Intake (g) | 562.50[b] | 671.00[ab] | 695.00[a] | 678.00[a] | 38.09 |
| Total DM Intake (g) (Basal diet + Conc.) | 807.25[b] | 916.00[ab] | 940.50[a] | 922.75[a] | 38.07 |
| DMI % BW | 2.84 [b] | 3.16 [a] | 3.17 [a] | 3.04 [ab] | 0.16 |
| Feed Intake (g) | 598.50 | 722.75 | 732.00 | 719.00 | 43.18 |
| Total Feed Intake g (Basal diet + Conc.) | 848.50 [b] | 971.50 [a] | 982.00 [a] | 969.75 [a] | 38.07 |

abc, means within the same row with different superscript are significantly different (P<0.05)

Average daily gain (ADG) increases from 71.43g/day for (treatment A) to 90.77g/day for (treatment D) with increased silage moisture along the treatments (P<0.05). Water Intakes ranged from 2.02 to 2.40 L/day (P<0.05).

Dry Matter Intake (DMI) from ensiled FSD and Cowpea hay increased from 562.50g/day for (treatment A) to 695g/day for (treatment C) (P<0.05). There was no significant difference (P>0.05) between treatments B, C and D in terms of DM and Total DM intakes. There were no significant difference between treatment B, C and D in terms of DMI as % Body Weight (P>0.05). The feed intake increased from treatment A (598.50g/day) to treatment C (732g/day) (P<0.05). Total Feed Intake also increased from treatment A (848.5g/day) to treatment C (982g/day) (P<0.05).

### Nutrient Intakes by Uda Rams

Nutrient intakes comprising ensiled materials and concentrate and amount of water consumed are presented in Table 6

**Table 6:** Nutrients Intake by the Rams from Ensiled Materials and Concentrate

| Parameters (g) | Treatments Silage moisture inclusion level | | | | SEM |
|---|---|---|---|---|---|
| | A (30% ) | B (40%) | C (50%) | D (60%) | |
| OM Intake | 478.25[b] | 735.75[a] | 592.00[b] | 592.00[b] | 37.56 |
| Total OM Intake (Basal diet + Conc.) | 705.50[b] | 815.00[a] | 823.50[a] | 817.00[a] | 32.57 |
| CP Intake | 51.82[b] | 68.93[a] | 72.35[a] | 75.50[a] | 4.06 |
| Total CP Intake (Basal diet + Conc.) | 91.50[b] | 107.50[a] | 112.00[a] | 115.16[a] | 4.19 |
| CF intake | 158.75 [b] | 184.00 [a] | 182.75 [a] | 186.75 [a] | 11.54 |
| Total CF intake (Basal diet + Conc.) | 226.50 [b] | 252.50 [a] | 250.50 [a] | 254.50 [a] | 11.62 |
| Ash intake | 84.25 [b] | 83.00 [b] | 99.00 [a] | 86.00 [b] | 5.42 |
| Total Ash intake (Basal diet + Conc.) | 101.75 [b] | 101.00 [b] | 117.00 [a] | 104.00 [b] | 5.50 |
| EE intake | 14.98 [c] | 18.05 [b] | 21.98 [a] | 17.75 [b] | 1.07 |
| Total EE intake (Basal diet + Conc.) | 23.72 [c] | 26.50 [b] | 30.73 [a] | 26.50 [b] | 1.07 |
| NFE intake | 286.25[b] | 367.75[a] | 356.00[a] | 352.25[a] | 1.11 |
| Total NFE intake | 402.50[b] | 484.00[a] | 472.00[a] | 469.00[a] | 21.06 |
| (Basal diet + Conc.) | 341.15[b] | 368.68[b] | 455.50[a] | 294.88[c] | 21.59 |
| NDF intake | | | | | |
| Total NDF Intake (Basal diet + Conc.) | 501.65[bc] | 529.18[b] | 616.00[a] | 455.38[a] | 21.59 |
| ADF intake | 191.53[b] | 295.08[a] | 264.25[a] | 257.49[a] | 15.76 |
| Total ADF Intake (Basal diet + Conc.) | 274.80[b] | 378.33[a] | 347.55[a] | 340.73[a] | 15.75 |

abc, means within the same row with different superscripts are significantly different (P<0.05)

Results indicated significantly higher CP and total CP intake, CF and total CF intake, NFE and total NFE intakes, ADF and total ADF intake for treatments 1, 2 and 3 (P<0.05). Intakes of all nutrients are significantly lower for animals fed silage mixture with lower moisture content (treatment A) (P<0.05).

### Nutrient Digestibility

Results indicated no significant difference in DM, CF and NDF digestibility between all the treatments (P>0.05). CP and NFE digestibility were higher for animals in treatment 3 (50% moisture level) (P<0.05). EE digestibility was not significant between tratements 2,3 and 4 (P>0.05).

**Table 7:** Nutrient Digestibility of Experimental Rams

| Parameters | Treatments Silage moisture inclusion level | | | | SEM |
|---|---|---|---|---|---|
| | A (30%) | B (40%) | C (50%) | D (60%) | |
| DM | 79.13 | 79.27 | 79.37 | 79.80 | 0.63 |
| CP | 84.86[b] | 89.39[ab] | 90.55[a] | 87.63[b] | 2.52 |
| CF | 74.35 | 74.57 | 74.14 | 73.50 | 1.28 |
| Ash | 82.59[b] | 84.93[b] | 87.05[a] | 86.39[a] | 0.81 |
| EE | 90.28[b] | 92.42[ab] | 92.23[ab] | 93.69[a] | 0.63 |
| NFE | 98.34[a] | 94.53[b] | 98.91[a] | 97.69[ab] | 0.78 |
| NDF | 88.74 | 88.87 | 89.91 | 85.68 | 0.76 |
| ADF | 86.41[b] | 92.04[a] | 92.44[a] | 91.08[a] | 0.68 |

abc, means within the same row with different superscript are significantly different (P<0.05)

### Cost of Feed and Cost of Feed per kg live weight gain

The cost of total feed consumed per ensiled feed intake (N/Kg) increased from N149.39/Kg for treatment A (30% moisture) to N182.71/Kg for treatment C (50% moisture). Cost of Total feed consumed per Total feed intake follows similar pattern. Cost of feed per Kg live weight gain was significantly (P<0.05) lower (N518/Kg) for treatment D (60% moisture) compared to other treatments.

**Table 8:** Cost of Feed and Cost of Feed per Kg Live Weight Gain

| Parameters | Treatments Silage moisture inclusion level | | | | SEM |
|---|---|---|---|---|---|
| | A (30% ) | B (40%) | C (50%) | D (60%) | |
| Cost of feed(N/Kg) | 36.18 | 41.67 | 45.78 | 38.63 | |
| Cost of feed consumed per Ensiled feed intake(N/Kg) | 149.39 | 180.40 | 182.71 | 179.53 | 10.54 |
| Cost of feed consumed per Total feed intake(N/Kg) | 848.16 | 972.36 | 981.61 | 968.86 | 43.16 |
| Cost of feed per LWG | 571.79[a] | 607.45[a] | 543.09[a] | 518.08[b] | 27.04 |

a,b means within the same row with different superscript are significantly different (P<0.05)

## DISCUSSION

### Physical Characteristics of Ensiled FSD and Cowpea Hay

The colour and odour of the ensiled materials (pale yellow and sweet aroma) was similar to the report of Binuomote *et al.* (2010), when invitro fermentation characteristics of ensiled cassava top and Guinea grass mixture were determined. The pH values (4.35 to 4.75) were however, higher than those obtained by Oduguwa *et al.* (2007) but within range indicated by El- Yassin *et al.* (1991). Generally, the lower the pH the better preserved and more stable is the silage. When silage environment becomes conducive for mould growth, it will results into musty, hot and unpalatable silages (Bill, 2003). Therefore, the scores for colour, aroma and pH obtained in the present study indicated that satisfactory silages were produced and fed to the experimental animals.

**Chemical Composition of the Experimental Diet**

Incorporation of ensiled FSD and cowpea hay in the diet of Uda lambs at varying moisture levels led to slight increase in crude protein content from treatment A (30% moisture) to treatment D (60% moisture). The crude fiber was higher than the values reported by Kwaido (2006) but lower than those obtained by Maigandi *et al.* (2002). The values are however similar to those reported by Fajemisin *et al.* (2010).

The values obtained for the ether extract were lower to those reported by Tukur and Maigandi (2010). The authors reported EE ranged of 4.3– 5.5%, when fattening rams fed varying levels of fore-stomach digesta. However, the EE values were higher than those obtained by Fajemisin *et al.* (2010). The differences might be due to higher amount of FSD (70%) inclusion in the present study. The NFE values are comparable to values obtained by Tukur and Maigandi (2010) and Sirajo *et al.* (2010). Ash contents was higher than those obtained by Kwaido (2006) and Usman (2005). The variation was due to the fact that, composition of FSD depends on the species of animal, the type of feed consumed, the season of the year and the time of sampling after feeding (Alhassan, 1985).

The neutral detergent fiber was similar to those reported by Iyange *et al.* (2010) while ADF is similar to those reported by Muhammad *et al.* (2008) and Kallah *at al.* (1997*)* when assessing ensiling quality of Columbus grass (*Sorghum almum).* NDF and ADF values are lower to those observed by Fajemisin *et al.* (2010). This variation could also be attributed to the type of feed consumed, the season of the year and the time of sampling after feeding (Alhassan, 1985).

**Performance characteristics of the experimental animals**

The increased feed intake with increased moisture content, could be due to the fact that, roughages of low quality tend to be eaten more by the animals in order to satisfy their needs for energy and other nutrients (McDonald *et al.,* 1995). Variation in feed intake between treatments could be as a result of individual differences among the experimental animals. One of the possible explanations for this is that, the animals were purchased from different sources with possible differences in management systems even though measures were taken to eliminate these differences at beginning of the experiment. Muhammad *et al.* (2008) had earlier reported that individual differences affected the rate of feed intake in sheep and other ruminants.

However, increase in total dry matter intakes with increased silage moisture up to 50% could be due to the fact that increased moisture content of a silage material could lead to increased fermentation which lowers bulkiness and indigestible components and leads to subsequent increase in feed intake as observed by Nelson *et al.* (1976).

The variation in ADG might be attributed to differences in crude protein and NFE intakes which increased with increased silage moisture contents. The ADG values of between 71-90g/day obtained in the present study was higher than 53- 77g/day reported by Abil *et al.* (1992), Usman (2005) and Olatunji *et al. (*2004) when the latter fed non-conventional feed rumen modifier to West African Dwarf sheep. The values are however comparable to those obtained by Maigandi *et al.* (2002). The variation could be due to higher digestibility and feed utilization as observed by Saleh *et al*. (2005). The difference in ADG could also be attributed to breed difference and individual animal differences as reported by Maigandi and Nasiru (2006).

**Nutrient Digestibility and cost production**

Generally, the higher DM and CF digestibility observed for all the treatments was due to the fact that the growing animals have sufficient micro-flora for efficient degradation of fibre McDonald *et al. (*1995) indicated that fibre fraction of a food as well as the species of animal has greater influence on digestibility. Higher digestibility observed for animals in treatments 2 and 3 was responsible for higher live weight gain and ADG observed for animals in these treatments.

Economic analysis of the performance of animals in this study indicated that even though ADG was not significantly affected up to 60% ensiled moisture content inclusion level, cost of feed per kg live weight gain was significantly lower (N518.08/Kg) (P<0.05). The cost of feed per kg live weight gain was lower than the values reported by Muhammad *et al.* (2008) but comparable to the values obtained by Kwaido (2006).

**CONCUSION**

Live weight Gain (LWG) and nutrients Digestibility was better at higher moisture inclusion level (50 and 60%). Cost of feed / Kg live weight gain was significantly lower for animals fed ensiled FSD and cowpea hay at 60% moisture level. It was concluded that FSD-cowpea hay mixture should be ensiled at higher moisture level.

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