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# Effect of Positioning of Feed Samples in Two Segments of the Rumen on *In-situ* Degradability of Feed Stuffs

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**Abstract:** The effect of positioning of Sorghum Stover and groundnut haulms at dorsal and ventral segments of rumen was investigated using Nylon bags for 4, 24 and 48 hours incubation in the rumen of two cannulated bulls. The 24 hour dry matter (DM) disappearance values were 60.05 (dorsal segment), 58.93 (ventral segments) for the groundnut haulm and 14.65 (dorsal segment), 15.75 (ventral segments) for Sorghum Stover respectively, with the following corresponding rates of degradability (C value) 0.010, 0.009, 0.005 and 0.004 respectively. The results showed no significant effect of positioning in the rumen. Expectedly the groundnut haulms were however degraded more than the Sorghum Stover, making the dry matter from the latter more available to the host animal than those of the former. The difference in the rate of degradation between groundnut haulm and sorghum stover must have rested on the degree of exposure of the degradable samples to the various rumen microbial species rather than that of rumen positioning of those feedstuff samples

**Key words:** Rumen degradability, *In-sacco In-vivo*, position of the rumen, groundnut haulm

## Introduction

A major constraint to livestock production in developing countries such as Nigeria is the scarcity and fluctuating quantity and quality of all year round feed supply. The future hope for feeding the rapidly growing human population in the sub-Saharan Africa and in Nigeria in particular will depend on the enhanced and efficient utilization of unconventional resources that cannot be used as food for humans or feed for livestock. (Ørskov, 1998: 1999)

In Nigeria ruminants are fed mainly on agro-industrial by-products containing a large portion of lingo-cellulosic feeds, such as cereal crop residues (straws and stovers) native pasture and other similar feeds. These feeds are usually poor in protein, energy, minerals and vitamins. (Kapu, 1975; Bogoro, 1997).

To predict which feedstuff and at what quantity can support productive functions in the animal their nutritive values must be ascertained The use of simple but robust techniques for evaluation of the nutritional quality of these feed resources will contribute to their efficient utilization. The most widely used method in Nigeria is the *in situ* incubation of samples in nylon bags in the rumen (Umunna *et al.*, 1995 ). This technique has been used for many years to provide estimates of both the rate and extent of disappearance of feeds constituents. The technique provides a useful means to estimate rates of disappearance and potential ruminal degradability of feed stuffs and feed constituents while incorporating effects of particulate passage rate from the rumen (Van Soest, 1994).

The provision of adequate good quality feed to livestock to raise and maintain their productivity is and will be a major challenge to scientist in this decade. It is also not very clear as to whether the rumen positioning of the substrates affect the rate of degradability. This experiment was therefore designed to examine the possible effect of positioning of feeds in two different compartments of the rumen (the dorsal and ventral sacs) on degradability rates. It is hoped that the result of the work will contribute to better understanding of the use of rumen cannulated bulls for feed evaluation.

## Materials and Methods

**Determination of the *in- situ in-sacco(in-vivo)* DM degradabilities of the feed stuffs:** Two previously rumen-cannulated White Fulani (zebu) bulls at the Abubakar Tafawa Balewa University Bauchi, Teaching and Research Farm were used. A detail description of the site and procedure for rumen cannulation has previously been given (Bogoro, 1997). The bulls were housed in individual pens for easy sampling. Clean water and mineral salt lick were provided *ad libutum*. The bulls were fed 10kg feed daily .The ration was given in two parts, at 08.30 hours and 16.00 hours in the proportion 2/3 and 1/3 of the ration respectively. Each of the diets was given as the sole diet for a preliminary period of 4 days before each was fed to the bulls for an experimental period of 2 days. The nylon bag method demonstrated by Ørskov *et al.* (1980 ) reported by Bogoro (1997) was used for the *in-situ in-sacco* rumen degradability. The nylon bags used were made of polyester filter cloth with an approximate size of 140mm×90mm with a mesh of 20-40µm. About 3g of each of the ground samples were placed separately in

Table 1: Composition of the experimental diet (%)

| Component | Diet |
|---|---|
| Dry matter | 92.59 |
| Crude protein | 12.19 |
| Ash | 7.89 |
| Neutral detergent fibre | 47.54 |
| Acid detergent fibre | 36.75 |

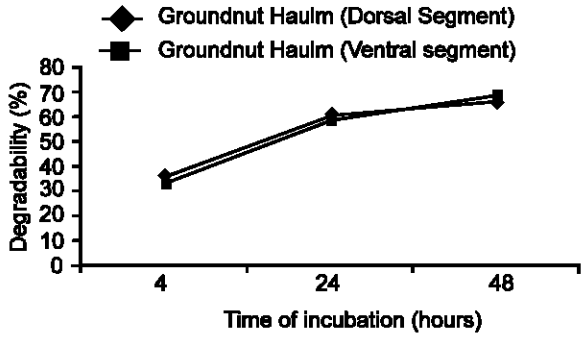


Fig. 1: Effect of posttioning on rumen degradability of ground nut haulm

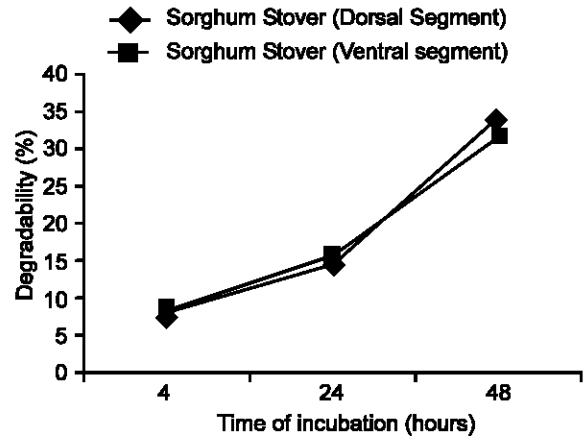


Fig. 2: Effect of positioning on rumen degradability of sorghum stover

24 nylon bags, that is 8 bags for each dietary sample at 4, 24 and 48 hours. Other procedures and protocol adopted for rumen degradation are as reported by Ani (1992).

**Positioning of feed samples:** In order to suspend the samples at dorsal and ventral sacs of the rumen, the bags were anchored by a plastic tube at cut length 25 and 50 cm for dorsal and ventral sac suspension respectively .

**Data collection and analyses:** The composition of the experimental diets are presented in Table 1.The diets were compounded with ingredients indicated in the Table. The experimental diets and feedstuffs were analyzed for their chemical composition using the method of AOAC (1984). The fiber (acid detergent fiber) was analyzed using the Van Soest *et al.* (1991) method. Nylon bags and contents used for the incubation (after 24 hours of oven drying) were weighed and recorded. Degradation constants of dry matter were estimated by fitting the formula of Ørskov and McDonald (1979) to the data generated from the incubation procedures. The formula was given as: $P=a+b(1-e^{-ct})$

Where,

P = is disappearance at time t

a = rapidly disappearing fraction (i.e. zero time intercept)

b = proportion of the feed which is slowly degraded with time

c = rate constant for degradation of b.

The data were analyzed using analysis of variance using Minitab ® (Rayan *et al.*,1985).

## Results

**Chemical Composition of the experimental diets and feedstuffs:** The chemical composition of the diet is presented in Table 1. While the composition of the various crop residues are presented in Table 2. The crude protein content of the feed stuff varied from low value of 3.4% for sorghum stover to 50.81% for groundnut cake. The ash content of groundnut cake was 4.99% and that of maize offal was 9.73%. The Nitrogen detergent fibre (NDF) and Acid detergent fibre (ADF) ranged from 40.61 to 65.16% and 12.51 to 52.82% for groundnut cake, maize offal, maize offal and sorghum stover respectively.

**Rumen degradability rates:** The degradability values of the various crop residues are presented in Table 3. The Table also shows the values of `a', `b' and `c' for all the samples. Groundnut haulm at the dorsal segment of the rumen had 24 and 48 hours degradability values of 64.99 and 66.14% respectively, while the ventral segment of the rumen for the same groundnut haulm had 58.93 and 68.69 % at the corresponding incubation times. Sorghum stover had low degradability at 24 hours and 48 hours of incubation. The values for dorsal segment were 14.32 and 34.29% respectively, while ventral segment had 15.15 and 31.72% at corresponding incubation times. Fig. 1 and 2 depict the degradation curves for the various feed samples.

## Discussion

Protein solubility and rate of flow of digesta are two major factors governing the rate of breakdown of dietary protein in the rumen (Ørskov, 1998) Suggestions have also been made that the degradation of protein supplements may be due to varying fibre content (Adamu *et al.*, 1988; Fomukong, 1995).

Fig. 1 and 2 illustrate two different patterns of degradability. Fig. 1 shows a very high degradability

Table 2: Chemical composition of the feedstuffs on dry matter basis (%)

| Parameters | Feedstuffs | | | |
|---|---|---|---|---|
| | Groundnut cake | Groundnut Haulms | Maize Offal | Sorghum Stover |
| Dry matter | 90.69 | 91.56 | 92.45 | 94.12 |
| Ash | 4.99 | 9.37 | 9.73 | 5.96 |
| Crude protein | 8.88 | 13.50 | 11.19 | 3.44 |
| Neutral detergent fibre | 40.61 | 54.56 | 65.16 | 46.51 |
| Acid detergent fibre | 20.62 | 30.92 | 36.75 | 52.82 |

Table 3: Rumen degradability rate (%) feed stuffs as influenced by type of diet ,position in the rumen and incubation time

| | Time of incubation (h) | | | | | | |
|---|---|---|---|---|---|---|---|
| Diet/position in the rumen | 4 | 24 | 48 | a | b | c | RSD |
| Groundnut Haulm (Dorsal ) | 35.38 | 60.05 | 66.15 | 29.20 | 66.15 | 0.010 | 4.02 |
| Groundnut Haulm (Ventral) | 32.98 | 58.93 | 68.69 | 27.7 | 68.69 | 0.009 | 3.80 |
| Sorghum Stover (Dorsal ) | 8.05 | 14.65 | 34.29 | 6.50 | 34.29 | 0.005 | 1.80 |
| Sorghum Stover (Ventral) | 8.25 | 15.75 | 31.72 | 7.0 | 31.72 | 0.004 | 1.30 |

RSD = residual standard deviation. a = rapidly disappearing fraction (i.e. zero time intercept). b = proportion of the feed which is slowly degraded with time. c = rate constant for degradation of b.

at both segments of the rumen. Further more, their 'b' and 'c' values were high, although at different time intervals there was slight variation in the degradability values obtained. Fig. 2 shows low rate of percent dry matter degradability in both segments of the rumen. The 'a' values were considerably low in comparison to Fig. 1 because of the nature of the feed.

Bogoro *et al.* (1997) reported *in vivo* average percent dry matter degradability of 59.60 for groundnut haulm. The value compares favourably with the value of 60.05 (dorsal segment) and 58.93 (ventral segment) obtained in the study of groundnut haulm at 24 hours. However Ani 1992 reported degradability values of 72.29%. Similarly degradability value obtained for sorghum stover 14.65% (dorsal segment) and 15.75% (ventral segment) were equally similar to 24 hour degradability value of 31.66 obtained by Ojo (1994) while Fomukong (1995) reported a percent dry matter degradability of 31.18 for un treated sorghum bearing in mind that the diet have great influence on degradability rates of the material being incubated. There was also no statistical difference.

This study thus suggest that positioning of feed sample in the dorsal or ventral segments of the rumen have no effect on their *in-situ* degradability. This result is in conformity with earlier findings of Erwin and Elliston (1959) and Rodriguez (1968 ).

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