# EFFECTS OF PROTEIN ON NITROGEN RETENTION AND SOME RUMEN FLUID VARIABLES IN YANKASA RAMS FED ACHA (*DIGITARIA EXILIS*) STRAW DIETS

**[1]Dangut, A. J., [2]Raymond, J. B.**
[1]Department of Animal Production, Abubakar Tafawa Balewa University P. M. B. Bauchi State, Nigeria, [2]Department of Animal Science, Federal University P. M. B. 1005 Gashua, Yobe State, Nigeria
Corresponding author email: ajdangut@yahoo.com +2348035867971, +2347085489822

**ABSTRACT**
A Completely Randomised Design was used to evaluate the effects of graded levels of protein on Nitrogen retention (NR) and some rumen fluid variables in Yankasa rams fed acha (*digitaria exilis*) straw (AS) diets. Sixteen rams initially weighing 13.20 – 13.55kg were used. Rams were randomly allotted to four dietary treatments of four animals. Each animal was offered 300g concentrate supplement (CS) daily, while AS was supplied *ad lib.* CS diets contained 11.0, 13.0, 15.0 or 17.0% CP but similar ME of 2400 Kcal/kg. Results showed that Rams on treatment 4 proved superior for total nitrogen intake, output and retained at $P<0.01$, $P<0.05$ and $P<0.05$ respectively. Ruminal pH remained unchanged before and 4hrs after feeding while ruminal ammonia nitrogen and total volatile fatty acids were highest ($P<0.01$) in treatment 4 rams. The values were least in treatment 1 rams. It was then concluded that AS supplemented with 17%CP and 2400 Kcal/kgME improved improve NR with rams showing increased Total ruminal ammonia nitrogen and Total volatile fatty acids in growing rams.

**Keywords**: Yankasa Rams Acha Straw Protein Nitrogen Retention Rumen Fluid

## INTRODUCTION
Scientists have advocated the feeding of supplements such as concentrates as part of the ways to improve the productivity of small ruminants (Aregheore, 2004). Concentrate feeds promote rapid growth of ruminants, reduce ruminal methane production and increase propionate production, thereby lowering energy losses and contributing to higher efficiency of nutrient utilization (McDonald *et al.*, 1998). The most common supplement fed to cattle in the traditional system is rice bran. Farmers also use some concentrate supplements because they realise the advantage of these to improve live weight gain. However, these supplements are considered very expensive and farmers prefer to make their own from a mixture of rice bran, tofu waste, cassava waste or soybean hulls. When feeding the host animal the aim should be to balance the protein: energy ratio in the nutrients absorbed (Kioumarzi *et al.*,2008).

## MATERIALS AND METHODS
### Animals and their management
Sixteen growing Yankasa rams with initial ages and weights ranging between 7 and 9 months, weighing 13.20 and 13.55 kg. Animals were identified by tags carrying numbers and then quarantined for three weeks during which they were administered a broad spectrum dewormer Leva suspension containing levamisole 20%W/V, Oxyclozanide 3.5% W/V and Cobalt Sulphate 0.4% W/V at a rate of 20mg, 35mg, and 4mg of Levamisole, hydrochloride, Oxyclonizade and Cobalt sulphate respectively per 10kg body weight. Rams were also treated against ectoparasites once every three weeks using a solution of Ecto-dateline containing Flumetrin 1% M/V and Cyluthrin 1% M/V. A 20% solution of Long Acting Oxytetracycline at the rate of 1ml per 10kg was used to prevent bacterial infection. During the adaptation period which lasted two weeks, a daily ration of acha straw*ad libitum* and 300g of a concentrate supplement (CS) containing 10% crude protein (CP) and 2000 Kcal/kg metabolisable energy (ME) were fed to each ram daily. Rams were reared intensively in well ventilated sheds with

concrete floor. Individual feeding and watering was achieved using separate containers. The experiment lasted for 84 days.

**Experimental diets and animal feeding**

Rams were weighed and randomly assigned to one of four experimental diets as presented in Table 1in a Completely Randomised Design. Feeds required for the whole experiment were prepared before the feeding trial commenced. Clean drinking water was provided *ad libitum*. After the adjustment period, rams were weighed and the appropriate CS was fed at the rate of 300g per head per day. However, the straw was supplied *ad libitum*. Acha Straw (AS) was obtained from the abandoned material after threshing of grains from an acha producing area (Jos, Nigeria) and was fed without any form of processing. The CS were formulated so as to contain different amounts of CP (11.0, 13.0, 15.0 and 17.0%) but similar concentrations of ME (2400 Kcal/kg) as presented in Table 1. Acha straw was used as the basal diet. CS diets comprised of raw fullfat soybean, yellow maize, groundnut cake, rice husk, bone meal, and salt. In the morning after removal of the leftovers, the supplement was fed and allowed to be consumed before filling feeders with the straw. The animals were individually fed the daily assigned supplement in two equal portions in the morning (between 0800 – 0830hrs) and evening (between 1600 – 1630hrs).

**Experimental design**

Sixteen rams were randomly assigned to four treatments in a Completely Randomized Design. Four feeds with levels of CP of 11.0, 13.0, 15.0 and 17.0% each having a ME of 2.4 Mcal/Kg served as treatments. Each treatment had four rams assigned (i.e four replicates per treatment).

**Data collection**

Parameters measured were:

Nitrogen retention of rams,

Ruminal: rumen fluid pH, Total Volatile Fatty Acids (TVAs), and Rumen Ammonia Nitrogen (RAN).

**Table 1**: Chemical and Energy Composition of Supplemental Feeds (%)

| Ingredient | Treatments | | | |
|---|---|---|---|---|
| | T1 | T2 | T3 | T4 |
| Dry matter | 92.83 | 92.66 | 92.11 | 92.37 |
| Organic matter | 84.11 | 83.96 | 83.36 | 83.67 |
| Moisture | 7.17 | 7.34 | 7.89 | 7.63 |
| Crude protein | 11.00 | 13.00 | 15.00 | 17.00 |
| Crude fibre | 16.29 | 15.98 | 15.81 | 15.43 |
| Ether extract | 3.28 | 3.82 | 4.28 | 4.73 |
| Ash | 8.73 | 8.70 | 8.75 | 8.70 |
| Neutral detergent fibre | 41.80 | 40.60 | 39.43 | 38.10 |
| Acid detergent fibre | 29.70 | 28.47 | 27.94 | 26.28 |
| Metabolisable energy (kcal/kg) | 2400 | 2400 | 2401 | 2400 |

**Rumen studies**

Ruminal liquor was collected from each ram on the $75^{th}$ day of the trial using suction tube which was manually operated. Samples were collected before feeding at 0730hrs and 4 hours after feeding. The fluid was immediately strained through cheese cloth and the pH was read with a digital pH meter. About 5ml ruminal fluid samples were stored in plastic containers into which 3 drops of concentrated hydrochloric acid were added. These were stored at $-4^{o}C$ and later analysed for ammonia nitrogen following the method of Markham (1942). Total volatile

fatty acids were analyzed using the Gas Chromatographic Determination of Volatile Fatty Acids method described by Ziolecki and Kwiatkowska (1975).

**Statistical analysis**

Data collected were subjected to Analysis of Variance (ANOVA) method as described by Steel and Torrie (1990) using the General Linear Model in SPSS for windows (2011). Where significant differences existed between means, Least Significant differences (LSD) was used to separate them (Steel and Torrie, 1990).

## RESULTS AND DISCUSSION

**Nitrogen retention in Yankasa rams fed acha (*Digitaria exilis*) straw with graded protein diets**

The results of study on nitrogen balance are presented in Table 2. The result indicated a linear and significant (P<0.001) difference in crude protein intake (CPI) due to protein supplementation. Rams CPI increased from 42.34 to 58.48g/day. Rams offered supplementary diets with 17% CP (treatment 1) had significantly (P<0.001) higher amounts of daily CPI (94.16g/day) as well as significantly (P<0.001) higher faecal N output (24.15g/day), the lowest CPI and faecal N were for rams on 11%CP with mean values of 42.34g/day and 20.20g/day respectively. Total nitrogen retained increased (P<0.001) with the CPI to the extent that the lowest amount retained per day (19.49g) was for rams on 11%CP while the highest amount retained per day (31.02g) was recorded against rams on 17%CP diet.

**Table 2**: Nitrogen Retention in Yankasa Rams Fed Acha *(Digitaria exilis)* Straw with Protein Diets

| Parameters | Treatments | | | | LSD |
|---|---|---|---|---|---|
| | T1 | T2 | T3 | T4 | |
| Total nitrogen intake (g/day) | $42.34^{d}$ | $48.43^{c}$ | $54.58^{b}$ | $58.48^{a}$ | *** |
| Faecal nitrogen (g/day) | $20.20^{c}$ | $21.66^{bc}$ | $23.06^{ab}$ | $24.15^{a}$ | ** |
| Urinary nitrogen (g/day) | $2.65^{c}$ | $2.91^{bc}$ | $3.04^{ab}$ | $3.27^{a}$ | *** |
| Total nitrogen output (g/day) | $22.85^{c}$ | $24.51^{bc}$ | $26.11^{ab}$ | $27.42^{a}$ | ** |
| Nitrogen retained (g/day) | $19.49^{d}$ | $23.93^{c}$ | $28.48^{b}$ | $31.02^{a}$ | *** |
| Nitrogen retained, % | $46.03^{c}$ | $49.39^{bc}$ | $52.18^{ab}$ | $53.08^{a}$ | ** |

**a,b,c,d**: means in the same row with different superscript are significantly different

** = P<0.01, *** = P<0.001. **Ns =** not significant. **LSD**= least significant difference.

**Effects of graded levels of protein on some rumen fluid variables in Yankasa rams fed acha (*Digitaria exilis*) straw diets**

Table 3 shows the ruminal fluid pH, rumen ammonia nitrogen (RAN) and total volatile fatty acids (TVFAs) sampled before feeding (BF) and 4hrs after feeding (AF). The values recorded for the both BF and AF sampling periods did not significantly (P<0.05) differ among treatment means with ruminal pH on protein supplementation. Mean pH range at BF sampling period was 6.15 -6.50 while the range for the AF sampling period was 6.50 – 6.70. Whereas the effect of increasing the level of CP on mean RAN at the BF sampling period did not show any significant (P>0.05) difference among the treatment means, the values at the AF sampling period was highly significant (P>0.001). For the BF period, the RAN values were within the range of 9.45 – 10.15mg/100ml. The range for the 4hrs AF sampling period was 11.00 –

13.85mg/100ml. The mean values for TVFA across treatments showed a significant (P>0.05) difference only for the AF sampling period with the values for the 11% CP diet having the least (12.30mmol/100ml) value while the greatest value (14.00mmol/100ml) was obtained for rams on 17% CP diet at the AF sampling period.

**Table 3**: Effects of Graded Levels of Protein on Some Rumen Fluid Variables in Yankasa Rams Fed Acha *(Digitaria exilis)* Straw Diets

| Parameters | Treatments | | | | LSD |
|---|---|---|---|---|---|
| | T1 | T2 | T3 | T4 | |
| Ruminal pH | | | | | |
| BF | 6.15 | 6.30 | 6.35 | 6.50 | Ns |
| 4hrs AF | 6.50 | 6.70 | 6.80 | 6.90 | Ns |
| Ruminal ammonia nitrogen (mg/100ml) | | | | | |
| BF | 9.45 | 10.00 | 10.00 | 10.15 | Ns |
| 4hrs AF | $11.00^{d}$ | $12.05^{c}$ | $12.80^{b}$ | $13.85^{a}$ | *** |
| Ruminal total volatile fatty acids (mmol/100ml) | | | | | |
| BF | 10.60 | 10.70 | 10.75 | 11.05 | Ns |
| 4hrs AF | $12.30^{c}$ | $13.00^{b}$ | $13.85^{a}$ | $14.00^{a}$ | *** |

**a,b,c,d**: means in the same row with different superscript are significantly different*** = P<0.001.**Ns =** not significant. **LSD**= least significant difference. **BF**= Before feeding, **AF** = After feeding

## CONCLUSION

It was then concluded that AS supplemented with 17%CP and 2400 Kcal/kgME improved improve NR with rams showing increased Total ruminal ammonia nitrogen and Total volatile fatty acids in growing rams.

## REFERENCES

Aregheore, E.M. (2004) Nutritive value of sweet potato (*Ipomea batatas* Lam) forage as goat feed: voluntary intake, growth and digestibility of mixed rations of sweet potato and batiki grass (*Ischaemumaristatum*var. Indicum). *Small Ruminant Research***51**(3): 235 – 241.

Kioumarzi, H., Jafari, J. K., Zehedifar, M., Zeiidavi, A. R., Mirhosseini, S. Z. and Taherzadeh, M. R. (2008). The effect of dietary energy and protein level on performance, efficiency and carcass characteristics of Tieshi lambs. *Asian Journal of Animal Veterinary Advances***3**:307-313.

Markham, R. (1942). A steam distillation apparatus suitable for macro-kjehldal analysis. *Biochemistry Journal***36**: 790 - 791.

McDonald, P., Edwards, R. A., Greenhalgh, J. F. D. and Morgan, C. A. (1998). Systems for expressing the energy value of foods; Animal Nutrition ($5^{th}$ edition) Longman group Ltd Singapore.pp. 244-259, 473.

Steel, R.G.D and Torrie, J.H. (1990): Principles and Procedures of Statistics. A Biometrical Application. $2^{nd}$Edition McGraw-Hill Book Co. New York,U.S.A.

Ziolecki, A. and Kwiatkowska, E. (1975). Gas chromatography of C1 to C5 fatty acids in ruminal fluid and fermentation media. *Journal of Chromatography*80(2): 250 - 254.