# EFFECT OF NITROGEN SOURCE ON AMMONIA, TOTAL VOLATILE FATTY ACIDS AND MICROBIAL PROTEIN IN THE RUMEN*

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Microbial proteins meet the protein requirement of the ruminants and rumen-undegraded proteins. In order to synthesize the body protein of microbes they utilize carbon and energy from total volatile fatty acids (TVFA) formed from carbohydrate fermentation and nitrogen from protein and non-protein nitrogenous substances in the feed. The quantity of microbial protein synthesized in the rumen depends on the degree of hydrolysis of feed protein and availability of energy from the ration. Ammonia, carbon skeleton and energy must be present in proper proportions and at proper time for efficient microbial protein synthesis. The study envisages the effect of two different rations varying in the nitrogen source on the levels of ruminal ammonia, TVFA and microbial protein.

## Materials and Methods

Six fistulated non-lactating crossbred cows aged four to five years were used for the study. The animals were fed with two different rations (R-I and R-II) which were isocaloric and isonitrogenous (Table) but varying in the major protein supplement.

The animals were fed once daily with three kg of concentrate along with five kg of straw for a period of 21 days to acclimatize the rumen ecosystem with the new ration. Water was provided *ad libitum*. After a period of 21 days the rumen liquor samples were collected through the fistula for three consecutive days. Rumen liquor samples were collected at every two hours interval upto eight hours post feeding after thorough mixing of rumen contents.

**Table 1.** Composition of rations (in gm and %) with two nitrogen sources.

| | Ration I | Ration II |
|---|---|---|
| Ground nut oil cake | 250 (25) | - |
| Gingelley oil cake | - | 350 (35) |
| Maize | 380 (38) | 300 (30) |
| Rice bran | 340 (34) | 320 (32) |
| Mineral mixture | 20 (2) | 20 (2) |
| Salt | 10 (1) | 10 (1) |
| Total | 1000 | 1000 |
| Paddy straw | 5000 | 5000 |

In the rumen liquor samples collected, ammonia ($NH_3$) was estimated as per the method of Weatherburn (1967). The TVFA concentration in the samples was estimated chromatographically as per the method described by Larry (1990). The microbial protein of the samples was estimated by the method of Lowry *et al.* (1951) after preparing the samples by the method of Makkar *et al.* (1982).

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Statistical analysis was conducted by factorial completely randomized design as per the method of Snedecor and Cochran (1994).

## Results and Discussion

The $NH_3$ concentration in rumen at different hours after feeding the two different rations are represented in Fig (1).

The mean $NH_3$ concentration in the rumen with first ration having ground nut oil cake (GNC) as chief nitrogen source ranged from 3.73 ± 0.41 mg/dl to 11.09 ± 0.6 mg/dl with a maximum concentration of 11.09 ± 0.6 mg/dl being at 6th hour post feeding and minimum concentration of 3.73 ± 0.41 mg/dl just before feeding. With ration II having gingelly oil cake (GOC) as nitrogen the mean $NH_3$ concentration ranged between 3.31 ± 0.37 mg/dl and 9.88 ± 0.18 mg/dl, the maximum value reached at sixth hour and the value was minimum at zero hour. There was no significant difference between the two rations as far as the $NH_3$ level was concerned.

The TVFA production at different hours pre and post feeding with the two different rations are presented in Fig(2). The mean TVFA concentration ranged from 61.52 ± 4.34 to 88.56 ± 16 mM/l with a maximum value at two

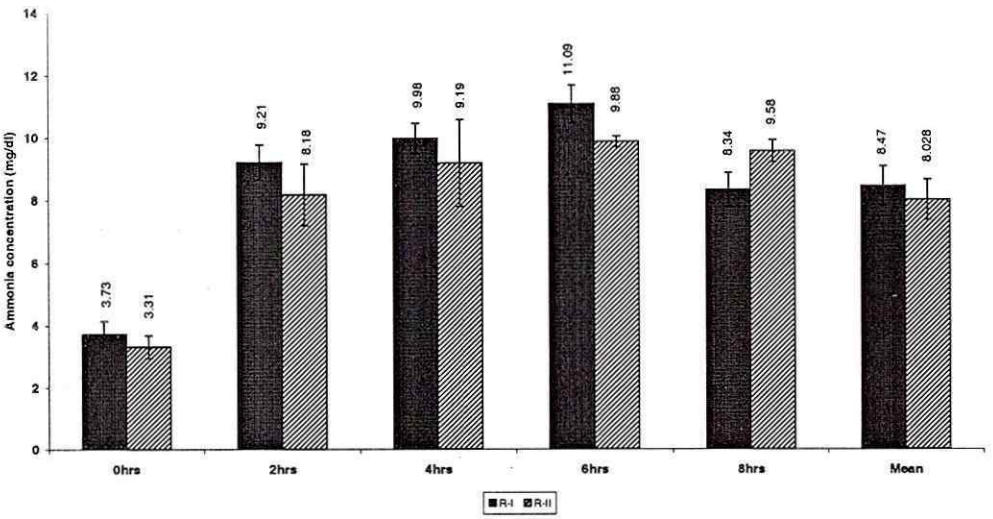


**Fig. 1.** Rumen ammonia concentration at different hours post feeding with different rations having GNC and GOC as nitrogen sources (n=6)

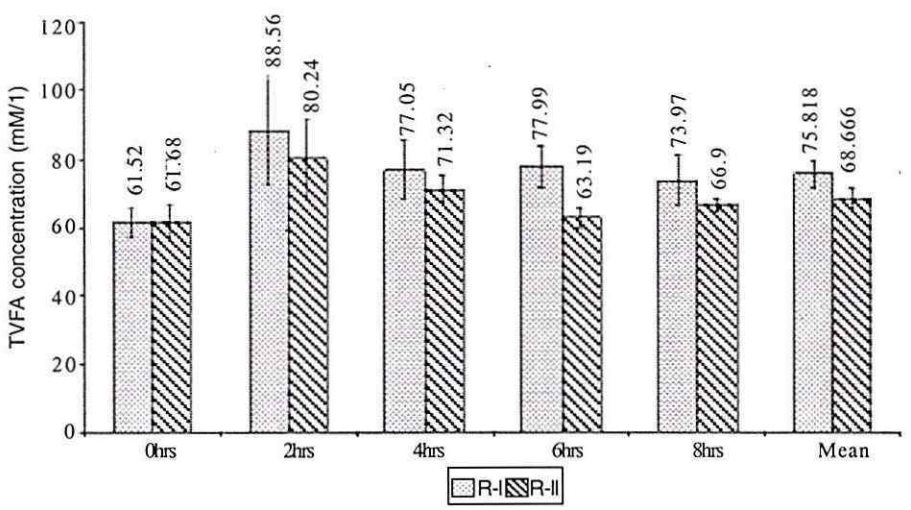


**Fig. 2.** Rumen TVFA concentration at different hours post feeding with different rations having GNC and GOC as nitrogen sources (n=6)

hour post feeding and minimum at zero hour for ration with GNC. For ration with GOC the TVFA level ranged from 61.68 ± 4.73 to 80.24 ± 11.58 mM/l with maximum value at second hour post feeding and minimum value at zero hour. There was no significant difference between the two rations as far as the TVFA level was concerned, however, the level was more with the ration containing GNC as the major protein supplement. In both the rations the maximum TVFA level was observed at second hour post feeding and minimum at zero hour. Slyter *et al.*(1979) observed a TVFA level of 102.9 mM/l in steers fed on a forage-concentrate mixture ration. In spite of the high rumen degradable protein content of the ration, the low TVFA level observed in this study may be due to the feeding of straw instead of the easily digestible forage fed by the earlier authors.

The microbial protein concentrations of rumen with the two different rations are represented in Fig(3). The mean rumen microbial protein concentration for ration I with GNC was 114.16 ± 3.23 mg/dl with a maximum concentration of 126.03 ±9.50mg/dl just before feeding and minimum concentration of 99.99 ± 4.5 mg/dl at second hour post feeding. For ration with GOC the mean microbial protein concentration was 130.00±8.42mg/dl, the maximum rumen microbial protein concentration (126.03 ± 9.86 mg/dl) observed just before feeding and a minimum level (95 ± 2.04 mg/dl) at fourth hour post feeding. There was no significant difference in ruminal microbial protein concentration with the two rations. Microbial protein concentration observed in this study was in agreement with the value reported by Makkar *et al.* (1982) in rumen fluid of fistulated calves and above the value reported by Cruz-Zoto *et al.* (1994) in rumen fluid of sheep receiving infusions of different nitrogen sources.

From the study it was observed that though the level of $NH_3$, TVFA and microbial protein production were not significantly different between the rations studied, the concentration of $NH_3$ and energy release in the rumen, from the ration with GNC was numerically higher than that from a ration with GOC resulting in a net increase in the microbial protein content of the rumen. The study showed that source of nitrogen does not have a significant effect on the ruminal ammonia, TVFA and microbial protein.

## Summary

The effect of two rations with groundnut oil cake (GNC) and gingelly oil cake (GOC) as the chief nitrogen source on the concentration of ruminal ammonia ($NH_3$), total volatile fatty acids (TVFA) and microbial protein were studied in non lactating crossbred cows at

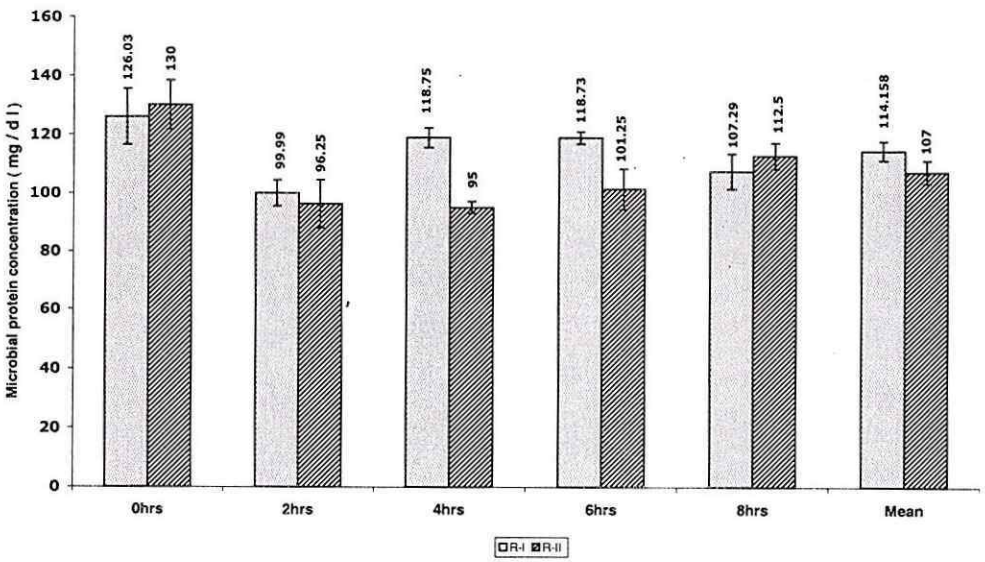


**Fig. 3.** Rumen microbial protein concentration at different hours post feeding with different rations having GNC and GOC as nitrogen sources (n=6)

different hours post feeding. No significant difference in the ruminal concentration of TVFA or microbial protein was observed between rations. However, TVFA and microbial protein were numerically higher in the animals fed with the ration containing GNC as the chief nitrogen source.

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