**COUNTRY:** BRAZIL

**SESSION:** RUMINANT NUTRITION

# RUMEN PARAMETERS OF COWS CONSUMING PROTEIN SUPPLEMENTS WITH UREA OR STAREA

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## ABSTRACT
Nitrogen supplementation may be done with sources of either true protein or non-protein-nitrogen such as urea or starea. The inclusion of starea would benefit rumen fermentation pattern due to the slow release of ammonia. The objective of this study was the evaluation of rumen parameters of cows receiving a protein supplement containing either urea or starea. Three crossbred (Holstein-Zebu) cannulated dry cows were assigned to 3 treatments on a Latin Square design: urea protein supplement, starea protein supplement and mineral (control). Periods consist of 7d-adaptation and 3d-sample collection. Cows were fed very low quality hay to mimic Central Brazil pastures during winter and one of the supplements. Ruminal fluid was collected every 2h during 2 days for pH, rumen volatile fatty acids and ammonia concentration determination. Intake of supplement or hay was not affected by treatments. Ruminal pH was not affected by treatments, with no time or treatment-time interaction effect. Rumen ammonia concentrations were higher for starea than mineral treatment ($P<0.08$), with no difference compared to urea. As expected, N supplementation increased ruminal ammonia concentration as compared to mineral supplement ($P<0.05$). Total and individual volatile fatty acid concentration was not affected by treatments. Time effect was significant with lower concentrations of propionate, butyrate and valerate between 16 and 18h. The C2/C3 ratio tended ($P<0.15$) to be higher for protein supplements as compared to mineral supplementation. N supplementation may improve rumen fermentation. However, these data suggests that there is no benefit of starea inclusion in protein supplements as compared to urea.

## KEYWORDS
Non-protein N, VFA, Ammonia

## INTRODUCTION
Due to reduced precipitation, temperature and shorter daylight during winter, there is a great decrease on tropical forage availability and quality in Central Brazil. Lower intake associated with poor forage quality results on reduced animal performance because of low protein, energy, minerals and vitamins intake (TOSI, 1996), increasing costs of production. Protein supplementation may improve animal

performance on low quality pastures systems by increasing voluntary forage intake (MCCOLLUM & HORN, 1989), due to increased digestion and passage rate. On low quality diets, feeding supplemental protein increases microbial activity, fermentation and passage rate, increasing voluntary intake and consequently animal energy status (KRYSL and HESS, 1993). Nitrogen supplementation may be done with sources of either true protein or non-protein-nitrogen such as urea or starea. The use of more degradable N source has two objectives: furnish ammonia for rumen microorganisms and limit supplement intake due to its low palatability. This situation presumes high-energy availability, for ammonia and energy synchronization, aiming maximal microbial efficiency (PAULINO et al., 1996). However, when there is no energy available, a source of nitrogen with a slow pattern of ammonia release, such as starea, will be preferable.
The present trial had the objective of evaluate differences on rumen parameters of cows receiving a protein supplement containing either urea or starea.

## MATERIALS AND METHODS

Three crossbred (Holstein-Zebu) cannulated cows were assigned to 3 treatments on a Latin Square design: urea protein supplement, starea protein supplement and mineral (control). Supplements were mixed on a commercial plant and starea was done by the extrusion of a mixture of 60% corn grain/40% urea.
Periods consist of 7 days adaptation and 3 days of sample collection. Cows were fed, every morning, ad libitum, a very low quality hay to mimic Central Brazil pastures during winter, and one of the supplements up to an intake of 0.1% live weight (LW). For dry matter intake calculation, weight backs of hay and supplement were recorded daily. Samples of hay and supplements were taken for Crude Protein (CP), Crude Fiber (CF), Ether Extract (EE), Ash, Calcium (Ca) and Phosphorus (P) concentration determination according to AOAC (1990) (Table 1).
Ruminal fluid was collected every 2h during 2 days, delaying 1 hour at the second day to have hourly measurements. Samples were taken from 3 rumen points and filtered throughout cheesecloth for particulate removal. Measurements of pH were done using a portable pH-meter (Jenway 3150) right after collection and samples were stored at -4°C for latter analysis. Samples were thawed on room temperature, centrifuged on 11,000 x g during 20 min and an aliquot was used for ammonia concentration determination according to CHANEY and MARBACH (1962). For volatile fatty acids determination, samples were re-centrifuged, being analyzed by the method described by PALMIQUIST and CONRAD (1971), on a gas-liquid chromatograph Hewlett Packard 5890, equipped with a HP integrator. The acid 2-methil-butiric was used as an internal marker.
Data were analyzed as a 3 x 3 Latin Square Design using GLM procedure (SAS, 1991), including time and period effects into the model.

## RESULTS AND DISCUSSION

Intake of supplement (g DM) or hay was not affected by treatments (Table 2). N supplementation did not increase forage intake (N supplement vs. mineral) as observed by MCCOLLUM & HORN (1989), mainly because the hay fed had a crude protein level slightly higher than that fed on situations when there is an increase on forage intake (<7%) (MINSON, 1990). However, when comparing N sources, urea supplement resulted on higher hay intake than starea supplement. Intake

reductions are observed when diet protein level is not enough to produce adequate ammonia in the rumen (ØRSKOV, 1988). Intake as a % LW was lower than expected (0,1%), probably because the animals were already on their mature weight. Ruminal pH was not affected by treatments, with no time or treatment-time interaction effect (Table 2). Other studies did not show differences on rumen pH when comparing urea and starea (OLIVEIRA JR., 2002; STILES et al., 1975; THOMPSON et al., 1972). The intake pattern of protein supplements leads to a more stable rumen pH than that observed with high energy supplements. On this trial the lowest pH observed was 6.63 (Figure 1).
Rumen ammonia concentrations were higher for starea than mineral treatment ($P<0.08$), with no difference when compared to urea supplement (Table 2). Other studies have shown lower ammonia concentration for animals fed with starea as compared to urea plus corn grain (HELMER et al., 1970; STILES et al., 1975). However, when corn grain was replaced by extruded corn grain there were no effects, suggesting that the lower ammonia concentration observed was a result of the grain processing and not the slow N release. HOOVER (1986) suggests that the values of ammonia concentration for maximal microbial protein synthesis have a wide variation, being from 3,3 to 21,5 mg/dL. As expected, N supplementation, either urea or starea, increased ruminal ammonia concentration as compared to mineral supplement ($P<0.05$), which shown values at the inferior borderline suggested by HOOVER (1986).
Total and individual volatile fatty acid concentration was not affected by treatments (Table 2), suggesting that there is no benefit of starea inclusion in protein supplements as substitute for urea. OLIVEIRA JR. (2002) and CARMO (2001) did not observed effect of non-protein-nitrogen source on total volatile fatty acid concentration with feedlot steers and lactating dairy cows, respectively. Since volatile fatty acids molar proportion reflects the fermentation substrate and that ruminal N is necessary for carbohydrate ruminal degradation, it was expected that Mineral treatment would show differences on fatty acids molar proportion. Time effect was significant with lower concentrations of propionate, butyrate and valerate between 16 and 18h. The C2/C3 ratio tended ($P<0.15$) to be higher for protein supplements as compared to mineral supplementation, as a result of the reduced acetic concentration (not significant). C2/C3 ratio may be used as an indicator of rumen stability. According to EASTRIDGE (1997), an acceptable C2/C3 ratio is between 3:1 and 2.5. These data show higher ratios (Table 2), as observed also by OLIVEIRA JR. (2002). However, higher values are associated to by-products feeding, such as citrus pulp, due to differences on fermentation pattern, which was not utilized on this trial.

## CONCLUSION

N supplementation may improve rumen fermentation. However, these data suggests that there is no benefit of starea inclusion in protein supplements as compared to urea.

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