Nutrient digestibility and ruminal characteristics of buffaloes and bovine fed additived sugar cane silages

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ABSTRACT: It was evaluated nutrients total digestibility (TD) and dry matter (DM) intake, pH and NH$_3$ ruminal concentration in buffaloes and bovine, fed sugar cane silages treated with *Lactobacillus buchneri* (SSL), plus 10% - cassava by-product meal (SSLC), plus 10% - soybean hulls (SSLS) or plus 1% - urea (SSLU). The experimental design was a double 4x4 Latin squares with a 4 x 2 factorial arrangement. There was no interaction between species x treatment for evaluated parameters except for TD of CP, NDF and ADF. The soybean hulls addition increased (P<0.05) TD of DM, OM and total carbohydrate (TC) while the urea addition reduced (P<0.05) DM intake and TD of DM, OM, TC and no fiber carbohydrate (NFC). Buffaloes showed the highest (P<0.05) TD of CP with SSL and the highest TD of NDF and ADF. Bovines showed the highest (P<0.05) TD of CP with the SSL and SSLS; the last increased TD of NDF and ADF. The rumen pH in buffalo was higher than in cattle (6.62 vs. 6.48, respectively). The NH$_3$ ruminal concentration did not differ between species and SSLU treatment presented the highest values (12.9 mg / 100 mL).

Key words: Buffalo, Cassava by-product meal, *Lactobacillus buchneri*, Soybean hulls.

INTRODUCTION - Sugar cane silages used in ruminant nutrition results in operational activity concentration and also allow taking advantage in terms of nutritive value in function of the harvest time. When sugar cane submitted to ensilage process, factors as the high soluble carbohydrate levels and the high epiphytic yeast population, take to alcoholic fermentation causing excessive decrease in dry matter and nutritive value of forage. So, to reduce these losses it was evaluated the sugar cane silage treated with different additives: microbial (*Lactobacillus buchneri*), chemical (urea) and agro-industrial residue (soybean hulls and cassava by-product meal) on intake, nutrients total digestibility, pH and N-NH$_3$ ruminal concentration in bovine and buffaloes.

MATERIAL AND METHODS - The experiment was carried out in the Experimental Station of Iguatemi while samples chemical analysis were done at the Animal Nutrition and Food Analysis Lab belonged to Animal Science Department of Maringá State University, Paraná State, Brazil.
Four Holstein steers (492 kg ± 10 of LW) and four crossbred buffaloes (403 kg ± 49 of LW) with ruminal fistulas were used. Animals were fed twice a day, with one of the four experimental diets, as follow characterized by a 60:40 forage: concentrate ratio, 12% of CP and 70% of TDN on the DM basis. The concentrate was composed by milled corn and soybean meal and the forage used was sugar cane silage (SC) treated with different additives: SSL - *Lactobacillus buchneri* (3.64 x 10⁵ UFC/g of green matter (GM)); SSLC - *Lactobacillus buchneri* + agro-industrial residue (cassava byproduct meal: 10% GM); SSLS - *Lactobacillus buchneri* + agro-industrial residue (soybean hulls: 10% GM); SSLU - *Lactobacillus buchneri* + urea (1% GM).

Feeds and refusal were daily weighted to estimate animals’ intake. The experimental period consisted of 14 days of adaptation and five days of samples collection. Faeces (100g) were collected straightly from the animals’ rectum at 8:00 and 16:00, during the collection period. Chromium oxide (Cr₂O₃) was used as external marker to determine the daily dry matter faecal flow. Ruminal fluid (70 ml) was collected throughout rumen cannula at 0 (immediately before first feeding), 2, 4, 6 and 8 hours after first feeding and the pH was measured immediately after sampling. To 50 ml of ruminal fluid was added 1 ml of sulfuric acid (1:1) to determine ammonia nitrogen concentration. Dry matter (DM), organic matter (OM), crude protein (CP), total carbohydrates (TC), no fibers carbohydrates (NFC), lignin and silica were analyzed as described by Silva & Queiroz (2002). Neutral detergent fiber (NDF) and acid detergent fiber (ADF) were analyzed according to Van Soest et al (1991).

The equation 100 - (% CP + % EE + % ash) was used to calculate TC and NFC were calculated by difference (TC–NDF<sub>cp</sub> (NDF corrected to CP)). The ammonia dosage was done using the procedure proposed by Ferner (1965) and adapted by Vieira (1980). The experimental design was a double 4 x 4 Latin Square with a 4 x 2 factorial arrangement. The statistical analyses were done using the genetic and statistic analysis system program (UFV, 1997) and the averages were compared by Tuckey test at 5%. The pH and N-NH₃ values were evaluated as a split-plot design considering sampling time as subplot.

**RESULTS AND CONCLUSIONS** - There was not (P> 0.05) specie and treatment interaction to DM intake (Table 1). The urea addition decreased (P<0.05) the DM intake to SSL that did not differed from SSLC. The highest intake (P<0.05) was observed to SSL and SSLS. The average DM intake did not differed (P>0.05) between species and the average values were 1.57 and 1.39% of BW in bovine and buffaloes, respectively.

The lower intake observed with SSLU was probably due the alcoholic fermentation with high levels of ethanol and volatile fatty acids that are intake suppressors. The urea inclusion to SSL decreased (P<0.05) DM, OM, TC and NFC total digestibility (TD). The highest lignin (8.90% in DM) and silica level (3.25% in DM) observed with SSLU compared to others treatments could be the cause of nutrients TD low values. By other hand, the soybean hulls addition to SSL increased DM, OM and TC total digestibility in relation to others treatments (Table 1). The nutrients TD increase with soybean hulls addition, probably, in function of their nutritional characteristics as the high NDF, ADF and pectin levels; low lignin concentration and high (more than 90%) in vitro digestibility (Zambom et al., 2001). Between species there was not difference to DM, OM, EE, TC and NFC total digestibility. Otherwise, to CP, NDF and ADF total digestibility it was observed an effect (P<0.05) of specie x treatment interaction (Table 2).
Table 1. Means and standard deviation (SD) for dry matter intake (DMI), and some nutrient digestibility coefficient for treatments and animal species.

| Variables | Treatments | Species | SD |
|-----------|------------|---------|----|
| DMI (% LW) |            |         |    |
| SSL      | 1.67A      |         |    |
| SSLC     | 1.55AB     |         |    |
| SSLS     | 1.70A      |         |    |
| SSLU     | 1.30B      |         |    |
| Buffalo  | 1.39       |         |    |
| Cattle   | 1.57       |         |    |
| Total digestibility | 1.55 ± 0.3 | |

DM %  
OM %  
EE %  
TC %  
NFC %  

Capital letters compared means within a line among experimental diets. Means followed by different letters differ by Tukey test (P < 0.05); SSL = sugar cane silage with Lactobacillus buchneri; SSLC = SSL + cassava by-product meal; SSLS = SSL + soybean hulls; SSLU = SSL + urea.

Table 2. Means and standard deviation of crude protein (CP), neutral detergent fiber (NDF) and acid detergent fiber (ADF) total digestibility coefficient for both species with the four diets.

| Nutrients | Buffaloes | Bovine |
|-----------|-----------|--------|
| CP %      | SSL       | SSLC   | SSLS  | SSLU  | SSL    | SSLC   | SSLS  | SSLU  | SD       |
| 57.6Aa    | 48.5Ba    | 49.3Bb | 49.2Ba | 58.3Aa | 51.3Ba | 61.0Aa | 50.4Ba | 53.2 ± 6.0 |
| NDF %     | 28.3Ba    | 21.8Ba | 45.7Aa | 28.4Ba | 35.1Ba | 23.2Ca | 44.6Aa | 19.5Cb | 30.8 ± 10.2 |
| ADF %     | 26.5Ba    | 22.4Ba | 42.8Aa | 28.7Ba | 31.4Ba | 19.6Ca | 42.3Aa | 17.4Cb | 28.9 ± 9.7 |

Capital letters compare means within a line among experimental diets inside animal specie while small letters compared means within a line between specie inside experimental diets. Means followed by different letters differ by Tukey test (P < 0.05). SSL = sugar cane silage with Lactobacillus buchneri; SSLC = SSL + cassava by-product meal; SSLS = SSL + soybean hulls; SSLU = SSL + urea.

Bovine had higher CP total digestibility compared to buffaloes only with SSLS treatment and not differ in the others treatments. Considering NDF and ADF total digestibility, buffaloes were higher than bovine to SSLU treatment. SSLU treatment had the highest values of NDF, lignin and silica and the lowest amount of NFC compared to others silage. This result agrees with literature which affirms that differences observed to fiber digestion between bovine and buffaloes are mainly related to low quality diets. Considering treatments inside species, the soybean hulls addition increased (P<0.05) NDF and ADF total digestibility in buffaloes and bovine, while CP total digestibility only increa-
sed in bovine. By other hand, the cassava by-product meal and urea addition decrease NDF and ADF total digestibility in bovine. Soybean hulls plus *Lactobacillus buchneri* addition to sugar cane silage results in higher DM intake and also increases DM and total carbohydrates digestibility for buffalo and cattle.

There was interaction only for sampling time x treatment to ruminal NH$_3$ concentration, with a cubic effect in function of sampling time (Figure 1a). The highest value observed was for SSLU with an average of 12.9 mg/100 ml and the lowest to SSLC (7.05 mg/100 ml).

To the pH in ruminal fluid it was observed a difference (P<0.05) among treatments (Figure 1b) and between species. The highest average pH values were observed to buffaloes (6.61) and the lowest (6.48) to bovine. Marked decreased in pH values were observed to SSLS and SSLC treatments but all treatments kept the average over 6.2.

Figure 1. pH of ruminal fluid (panel a) and ammonium nitrogen concentration (N-NH$_3$ - mg/100 ml) (panel b) over time in function of treatments
SSL = sugar cane silage with *Lactobacillus buchneri*; SSLC = SSL + cassava by-product meal; SSLS = SSL + soybean hulls; SSLU = SSL + urea.