Characterization of ruminal indicators of Charolais cattle from Cuba fed with *Pennisetum purpureum* cv. Cuba CT- 115 forage. Technical note

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In order to characterize microbial populations and fermentation indicators of fattening in Charolais cattle from Cuba four bulls in the ending of the fattening stage were used, which were under the *Pennisetum purpureum* cv. Cuba CT-115 grazing regime. For fulfilling the study ruminal fluid was extracted using a esophageal tube. Results were analyzed with STATGRAPHICS computer program to obtain the mean and standard deviation of the analyzed indicators. A total of 26.67 $x10^{10}$ cfu mL^{-1} of viable bacteria population was found, as well as 46.38 $x10^{8}$ cfumL^{-1} of methanogenic bacteria. The pH of the ruminal fluid was 7.75 and the concentrations of NH_3 and total SCFA were 7.75 meq L^{-1} and 83.44 mmol L^{-1}, respectively. It can be concluded that the microbial populations and the fermentative indicators are among the expected ranges for ruminants fed with fibrous diets as their only source of food. More comprehensive studies that contribute to deepen the knowledge about the ruminal fermentation in this breed are suggested.

Key words: *Ruminant indicator, charolais cattle, Pennisetum purpureum*

Cuban Charolais breed has adapted to the tropical climate thanks to its high rate of average daily gain (ADG) and its carcass quality (Díaz *et al*. 2008). Rico *et al*. (1987) stated that this breed obtained 335 kg of LW after 18 months old, with 0.632 kg of ADG, in behavior tests in grazing of pure grasses. These characteristics show the potential of this breed as a meat producer under the feeding and management conditions in Cuba.

However, until this moment, no studies covering the fermentative processes that occur in the rumen of Charolais animals were developed, which can contribute to the decision-making in the management and feeding of this breed, so important in the meat production. That is why the objective of this study was characterizing the microbe populations and some indicators of the ruminal fermentation of Charolais bulls, fed with forage of *Pennisetum purpureum* cv Cuba CT-115.

Four bovine animals from Charolais breed were selected out of a group at the end of the fattening stage from "Ayala" unit, belonging to the Institute of Animal Science. These animals had an average weight of 363 kg and they were under a grazing regime with *Pennisetum purpureum* cv Cuba CT-115 during the day, from 9:00 a.m. to 4:00 p.m. The rest of the time they were kept in stables with shadow and free access to water with forage from the same pasture during the night.

The experiment was carried out during the dry period. The animals grazed within 2 ha of biomass banks (74% *Pennisetum purpureum* cv. Cuba CT-115, 23% of other grasses and 3% of weeds), divided into eight paddocks, 0.25 ha each. The self grazing was used, the area was neither fertilized nor irrigated and the stocking rate was six animals per hectare. The occupation time was five days. The bromatological composition of *Pennisetum purpureum* cv. Cuba CT-115 is shown in table 1.

The adaptation period of animals to the diet was of 15 d previous to the sampling. Ruminal fluid was extracted from the animals using a probang. For that purpose the animal were taken to a stock at 9:00 a.m. before moving them to the grazing. Samples were kept in jars hermetically closed which were introduced in ice for taking them to the lab. Later, this liquid was filtered with muslin in order to remove food particles and carry out anticipated measurements. Some samples were preserved in a solution of 2.5% sulphuric acid, oversaturated with magnesium sulfate for carrying out analysis of SCFA and for ammoniac with HCl (0.1 N).

According to Hungate (1970), the sowings were performed using anaerobiosis techniques, in rolled tubes. The whole viable cellulolytic bacteria were sowed in the Caldwell and Bryant (1966) medium and modified by Elías (1971). Methanogenic bacteria were grown in the medium described by Anderson and Horn (1987), with a mixture of hydrogen and carbonate dioxide (60:40). Fungi were grown in the culture medium of Joblin (1981). The pH was measured in pH digital meter, the ammonium according to Conway (1957) and the total SCFA were determined regarding the stated by Pennington (1952). Results were analyzed according to SAS (1997) computer program in order to obtain the means and standard deviation of the analyzed indicators.

Table 1. Bromatological composition of *Pennisetum purpureum* cv. Cuba CT-115 (%)

DM	Ashes	CP	CF	KOH[1]	Ca	P
92.20	8.76	9.01	35.54	47.99	0.58	0.18

[1]OM digestibility

Rumen is considered as a complex ecosystem of vital importance in the animal productivity. Although the composition of the microbiota that inhabits each animal is unique, studies have demonstrated that it has a stable core and several environmental factors influence on the presence of different genre of microorganisms (Hernandez *et al*. 2010 and Jami and Mizrahi 2012).

Table 2 shows the results of this study. The values obtained for the populations are similar to the ones informed by Moon *et al*. (2010) for other ruminants which consume diets with high contents of fiber. These authors compared the populations of Holstein bovine, ovine and caprine, fed on the same diet, and found that the bacteria and fungi populations were in the order of 10^{-10} cfu $mL^{-1}$and 10^{-3} tfu mL^{-1}, respectively.

found, in studies about the ruminal fermentation with river buffalos fed with *P. purpureum* cv. Cuba CT-115, a concentration of 4.34 mg N 100 mL^{-1} of $N\text{-}NH_3$. This author points that buffalo cattle presents a higher efficiency in the use of fibrous foods in the rumen than other ruminant species. This can happen because of a high cellulitic activity, so the degradability of fiber and other nutrients present in low quality forages is higher than in beef cattle. In this study, the values of $N\text{-}NH_3$ allow to consider the exploitation of Charolais breed, like the buffalo, as a good alternative for tropical climate. It appears that, in spite of being a specialized pure breed, its power of adaptability allows to reach good productive results under the Cuban conditions and with feeding plans based on forages. Nevertheless, the possibility of

Table 2. Characterization of ruminant populations and fermentative indicators of Charolais bulls in fattening stage which consume *Pennisetum purpureum* cv. Cuba CT 115

Indicators	Mean	Standard deviation
Total bacteria (10^{-10}cfu mL^{-1})	26.67	1.79
Mmetanogenic bacteria (10^{-8}cfu mL^{-1})	46.38	3.09
Cellulolytic bacteria(10^{-4}cfu mL^{-1})	1.77	3.02
Cellulolytic fungi (10^{-3} tfu mL^{-1}l)	7.34	1.06
pH	7.75	0.09
SCFA total (mmol L^{-1})	83.44	13.37
NH_3 (meq L^{-1})	7.75	0.09

cfu- colony forming units.
tfu- tallus forming units

Galindo *et al*. (2007), evaluating the effects of the composition of the *Leucaena leucocephala* grassland, associated eith grasses (mixture of natural pastures) in the whole area, in the ruminal population of Cebú bulls, found counts of total bacteria, in the order of 20 x10^{-10} cfu mL^{-1}, similar to the results obtained in this research, in which the animals consumed a diet without a nitrogen source.

The pH values over seven are explained for animals that consume forages as their only source of food, because these diets lead to recycling a considerable amount of saliva as a result from the great time the animal uses to consume and ruminate food. Besides, the ruminal fluid extracted through the use of a probang may contain certain amount of saliva, which increases the pH of it.

Values of the ammonium concentration were low (7.75meq L^{-1}), as expected for a diet based on forages, with an average content of crude protein. These results were similar to those informed by Galindo *et al*. (1993) in studies with Holstein bulls, fed with residues from sugar cane cleaning centers. This concentration corresponds to a value of ammoniac nitrogen ($N\text{-}NH_3$) of 10.85 mg N 100 mL^{-1}. This value is superior to the one required to reach an optimum rate of fiber digestion (5.0 mg $N\text{-}NH_3$ 100 mL^{-1}) (Kennedy and Hogan 1994).

With respect to the previous result, González (2003) potentiating the fermentative abilities of rumen in this breed has to be considered, in order to achieve better productive results from the application of the concept of ruminal fermentation management.

It can be concluded that the microbial populations and the fermentative indicators are among the expected ranges for ruminants fed with fibrous diets as their only source of food. More comprehensive studies about the populations and proportions of SCFA that lead to a deeper knowledge about the fermentation of fiber foods in this breed, with a view to potentiate the fermentative abilities of rumen due to its importance in the meat production.

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