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INSTRUMENTAL AND SENSORY PROFILE OF BEEF CATTLE SUPPLEMENTED WITH CRUSHED CRAMBE

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Abstract – The aim of this work was to evaluate the tenderness of meat by shear force, pH, cooking loss and water holding capacity. For the evaluation of the sensory characteristics of the meat, panel was conducted with the aid of 50 untrained panelists for evaluation of odor, taste, tenderness and overall appearance. 17 samples of sirloin steak (*Longissimus* muscle) collected between the 12th and 13th rib of the left half carcasses of Nellore cull cows, 5 years old, finished on pasture and supplemented in the amount of 1.0% of body weight with inclusion of crushed crambe in the proportions of 0, 5, 10 and 15% in the supplement to replace soybean meal were used. The concentrates were isoenergetic with TDN value of 80%. There was a linear effect on pH, and water-holding capacity, cooking loss, and shear force no significant effect was observed. Sensory analysis for odor, taste, tenderness and general appearance, showed an average of 2.19, 2.24, 2.66 and 2.36%. The inclusion of crushed crambe replacing soybean meal does not alter the quality of the meat from Nellore cull cows.

Key Words: biodiesel, by-product, sensory analysis, shear force.

I. INTRODUCTION

Crambe has 50-60% of erucic acid, which is an omega-9 polyunsaturated fatty acid and is considered a biodegradable acid [1]. Presents as main characteristic the high oil concentration and can be used in biodiesel production.

Crushed crambe has a high protein (20% to 30%), ether extract (approximately 29%) and low-digestible fibers content, with potential use for ruminants. It consists of pericarp, rich in fiber, and cotyledons, rich in protein and residual oil.

Meat from *Bos taurus indicus* is recognized as less tender than that of *Bos taurus taurus* due to the proportion and activity of calpain/calpastatin enzymes [2]. Zebu animals exhibit a lean carcass in the muscular portion, devoid of marbling where only 2-3% lipids, and may have a good finish depending on the feed and weight of the animals. This fat distribution is of utmost importance in beef carcass, protecting it from burning cold.

This work aimed to study the qualitative characteristics of meat from animals finished on pasture supplemented with inclusion of crushed crambe to replace soybean meal in the diet.

II. MATERIALS AND METHODS

17 samples from the sirloin steak (*Longissimus* muscle) of Nellore cull cows, 5 years old, were used, finished on *Brachiaria humidicola* pasture during the transition period water – dry, supplemented in the amount of 1.0% of body weight with crushed crambe included up to 15% in diet, which concentrates were isoenergetic with 80% TDN. The amount of ingredients and chemical composition of the concentrates are shown in Table 1.

Table 1. Amount of ingredients (%) and chemical composition of the concentrates (g kg $^{-1}$DM).

Ingredients	Treatments			
	C00	C05	C10	C15
Crushed Crambe	0	5,0	10,0	15,0
Soybean meal	15,0	10,0	5,0	0,0
Integral rice brean	40,0	40,0	40,0	40,0
Corn	37,64	37,29	36,94	36,59
Urea	0,35	0,70	1,05	1,40
Salt	1,0	1,0	1,0	1,0
Limestone	2,5	2,5	2,5	2,5
Flower of Sulphur	1,0	1,0	1,0	1,0
Dicalcium phosphate	1,5	1,5	1,5	1,5
Mineral Mix[1]	1,0	1,0	1,0	1,0
Parameters	Chemical Composition (g kg^{-1} DM)			
DM	926,9	936,7	923,6	922,0
CP	153,4	155,0	145,7	140,0
EE	96,0	99,1	99,8	114,3
NDF	518,7	421,0	363,9	390,8
ADF	74,9	91,1	64,7	67,1
HCEL	433,8	326,4	302,6	322,7
LIG	47,2	49,1	28,1	31,3
CNE^{+}	384,2	476,3	532,3	492,6
TDN^{+}	843,6	796,7	802,5	813,1
TCHO^{+}	636,5	618,0	631,2	620,0
MM	137,0	126,1	123,3	125,6

C0=concentrate no crushed crambe inclusion; C5=concentrate with 5% crushed crambe inclusion; C10=concentrate with 10% crushed crambe inclusion; C15=concentrate with 15% crushed crambe inclusion. %CHOT = 10-(%PB+%EE+%MM); %CNE=%CT-%NDFp; %TDN = 9,6134+0,829DMD.

At the end of the experimental period, when cows had minimum body condition score of 5 in a scale of 1 to 9, they were subjected to a fasting period of 24 hours and subsequently slaughtered in a commercial abattoir.

After cooling of carcasses at 2 °C for 24 hours, was held in the left half-carcasses, between 12th and 13th rib, a cut to expose the cross section of *Logissimus* muscle, where was collected samples from approximately 0.8 kg which was divided into three steaks and frozen at -18 °C for assessment of the qualitative characteristics of meat.

Measurements of softness by shear force (SF) were performed as described by Wheeler *et al*. [3] and cooking loss (CL), were performed according com Abularach *et al*. [4]. Samples were defrosted for 24 hours under refrigeration (4 ° C) and cut into steaks 2.5 cm thick and baked in a preheated electric oven at 170 º C, until reaching 70 ° C at the geometric center. Cooking loss were calculated from the difference in weight of the samples before and after cooking, expressed as a percentage.

After being baked, the steaks were left at ambient temperature for at least 2 hours, and removed six samples (cylinders) using a punch of 1.27 cm in diameter, in order to determine the softness through the shear force through the device Texture Analyser TA. XT Plus (Stable Micro Systems), with a standard Warner Bratzler blade. The average cutting force of the cylinders was used to represent the shear strength of each sample and calculated as described by Vaz *et al*. [5].

The water-holding capacity (WHC) was obtained by difference between the weight of a meat sample (approximately 2 g) before and after being subjected to the pressure of 10 kg for 5 minutes as described by Hamm [6].

For the evaluation of the sensory characteristics of the meat, the remaining steaks from each sample were baked as described above and, after being cooled, cut into cubes and served 50 untrained panelists. In this panel, were evaluated the attributes odor, taste, tenderness and general appearance. The descriptive method of evaluating attributes through unstructured scale of nine points (1-9), whose left end is the lowest stimulus intensity and the extreme right to higher intensity was used [7].

III. RESULTS AND DISCUSSION

Despite variations of observed values for water retention, the best way is to freeze the steaks, differing from the usual method of freezing the entire section of the sirloin steak. The freezing of parts of the muscle (steaks) improves freezing speed, causing less loss of intracellular fluids,

because does not occur to the formation of ice crystals inside the cells during freezing.

The meat can be considered as rigid, with an average shear force (SF) 8.60 kgf being considered a soft flesh values below 5.0 kgf [8].

High values of shear force are common in Zebu animals and this characteristic is possibly associated with increased activity of calpastatin enzyme, which has an inhibitory effect on calpain responsible for postmortem proteolysis and therefore by tenderizes meat [9]. According to Lawrie [10], other factors such as age of the animal and carcass fat cover are crucial on this characteristic. Older animals have collagen and elastin structures more insoluble and carcasses with inadequate fat cover are more prone to shortening of muscle fibers during cooling (cold-shortening), factors that directly imply the absence of meat tenderness.

Linear effect is observed for pH, with the inclusion of crushed crambe (Table 2). There was no occurrence of DFD meat (dark firm and dry) or dark color cuts, which usually occur when the pH is above 6.0, due to lower mobilization of glycogen and consequently lower oxygen penetration [11], with pH values between 5.40 and 5.60 for normal or typical meat [8].

Table 2. pH, water holding capacity (WHC), cooking loss (CL) and shear force (SF) in beef steak of Nellore cull cows with crushed crambe include in the diet.

	Tratamentos					P<0,05	
Item	0	5	10	15	EPM	L	Q
pH	5,7	5,7	5,8	5,9	0,02	0,03	NS
WHC (%)	80,1	74,0	69,5	69,1	1,24	NS	NS
CL (%)	36,7	39,8	35,5	36,0	0,47	NS	NS
SF (kgf)	8,6	8,9	8,9	8,0	0,10	NS	NS

NS – not significat (P>0,05)
pH – Y= 0,562+0,0655X (R^2=0,2803)

Sensory analysis of meat had no significant effect on the variables: Odor, taste, tenderness and general appearance, shown in Table 3.

Table 3. Parameters of the sensory analysis of meat from Nellore cull cows fed crushed included in the diet.

	Treatments			
Item	0	5	10	15
Odor*	2,12	2,20	2,25	2,22
Taste*	2,15	2,00	2,40	2,42
Tenderness*	2,70	2,35	2,87	2,72
General appearance	2,40	2,20	2,47	2,40

*NS = not significant at 5% Kruskal – Wallis's test

Values for softness found in this study had an average of 2.66 showing a less tender meat. For Wheeler *et al*. [12], this is due to the higher concentration of calpastatin in muscle of animals. The action of calpastatin is in the form of inhibition of calcium-dependent proteolytic enzymes (CDP I and CDP II). Gerrard *et al*. [13] explain that there is interaction between sexual status and age at slaughter influencing meat tenderness. These authors working with animals ½ Charolais breeds showed a continuous decrease in meat tenderness with aging.

The tenderness, according Brondani *et al*. [14], is also relates to losses during thawing, showing that the higher the percentage of loss, meat is tougher. Still proves when softness was assessed by shear force, which besides the percentage of loss during defrosting shows a significant correlation with the cooking loss, especially drain. Thus, the greater the loss by drainage, more force is required to shear the fibers.

In sensory analysis the characteristic of smoothness, is the most important, being a determinant of the quality of meat [11]. By the review panel, the meat from Nellore cull cows were classified as rigid, similarly, when assessed

by Shear Force, obtained the confirmation of this stiffness.

IV. CONCLUSION

Nellore cull cows finished on pasture, supplemented with crushed crambe replacing soybean meal, in the transition period water - dry does not affect the meat quality.

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