

FATTY ACID PROFILE IN LONGISSIMUS OF CATTLE FINISHED IN PASTURE SUPPLEMENTED WITH CRAMBE CRUSHED

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Abstract – Through this work aimed to evaluate the inclusion of crambe crushed replacing soybean meal in the animal diets, in the fatty acid profile of cull cows meat finished in pasture. In the samples from the tenderloin (*Longissimus* muscle) of cull cows finished in pasture receiving crambe crushed in diet, were determined the composition of fatty acids. The stearic acid (C18:0) showed significant effects with an average of 254 g/ kg, but this fatty acid is considered neutral in the plasma cholesterol level. The behenic (22:0) and lignoceric fatty acids (24:0) were significant with mean values of 0.33 and 0.90 g/ kg respectively. The ratio between polyunsaturated fatty acids and saturated fatty acids showed the minimum values for beef of the cows feed with of the crambe crushed. Nellore cull cows finished on pasture supplemented with crambe crushed replacing soybean meal in the transition period water-dry does not provide negative changes in quality of fatty acids. The inclusion of up to 15% of crambe crushed in the diet of cull cows caused a desirable fatty acid profile, once the ratio between unsaturated fatty acids and saturated fatty acids showed acceptable values.

Key Words – biodiesel, co-product, cull cows

I. INTRODUCTION

The pastures represent the most practical and economical way to feed cattle and accounts for 95% of total weight gain of animals slaughtered annually in Brazil [1]. Pasture supplementation is a great alternative in order to supply scarce nutrients available in forages, and limiting nutrient for the growth and performance of beef cattle.

In animal production systems the food represents the largest expense, standing generally around

70% of the total cost. Thus, it is necessary to evaluate possible alternative food to ensure consistent rates of animal performance with good profitability.

In this way a co-product that stands out is the crambe crushed, obtained by pressing the grain. This has a high protein content (20-30%) and energy (around 29%) and is considered a good alternative in ruminant feed, thus reducing the disposal of waste in the environment [2]. Thus, the characterization of the nutritional value of alternative foods is very important for producers and nutritionists because it allows better evaluation of their advantages and limitations or in animal production.

Through this work aimed to evaluate the inclusion of crambe crushed replacing soybean meal in the animal diets, in the fatty acid profile of cull cows meat finished in pasture.

II. MATERIALS AND METHODS

17 samples from the tenderloin (*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% TND. The amount of ingredients and chemical composition of the concentrates are shown in Table 1.

Table 1 Percentage of ingredients (% of DM), DM rate (% of natural matter – MN) and chemical

composition (% DM) of concentrated supplements with and without the inclusion of crambe crushed replacing soy bran

Ingredients	Inclusion of crambe crushed (% DM)			
	0	5	10	15
Crambe crushed	0	5.0	10	15
Soybean meal	15	10	5.0	0.0
Whole rice bran	40	40	40	40
Corn	38	37	37	37
Urea	0.3	0.7	1.1	1.4
Salt	1.0	1.0	1.0	1.0
Limestone	2.5	2.5	2.5	2.5
Sulfur	1.0	1.0	1.0	1.0
Bicalcium phosphate	1.5	1.5	1.5	1.5
Mineral mixture ¹	1.0	1.0	1.0	1.0
Chemical Composition				
Dry matter	92.7	93.7	92.4	92.2
Crude protein	15.3	15.5	14.6	14.0
Ether extract	9.60	9.91	9.98	11.4
Neutral detergent fiber	51.9	42.1	36.4	39.1
Acid detergent fiber	7.49	9.11	6.47	6.71
Hemicellulose	43.4	32.6	30.3	32.3
Lignin	4.72	4.91	2.81	3.13
Non-fiber carbohydrates	38.4	47.6	53.2	49.3
Total digestible nutrients	84.4	79.7	80.2	81.3
Total carbohydrates	63.6	61.8	63.1	62.0

¹ Guarantee levels (kg product-1): Calcium: 120.00 g; Phosphorus: 88.00 g; Iodine: 75.00 mg; Manganese: 1,300.00 mg; Sodium: 126.00 g; Selenium: 15.00 mg; Sulfur: 12.00 mg; Zinc: 3,630.00 mg; Cobalt: 55.50 mg; Copper: 1,530.00 mg; Iron: 1,800.00 mg. % total carbohydrates = 100 - (% CP + % EE + % MM); % non-fiber carbohydrates = % TC - % FDNcp; % Total Digestible Nutrients = 9.6134 + 0.829 * DMS.

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.

It was determined the composition of fatty acids from samples of the cross section of tenderloin and lipids were obtained with a mixture chloroform-methanol, according to the methodology developed by Bligh [3]. For transesterification of the

triglycerides was used the method of ISO 5509 [4] in solution in n-heptane and KOH/ methanol.

The methyl esters of fatty acids were separated into gas chromatograph Thermo, model ultra trace 3300, equipped with a flame ionization detector and a fused silica capillary column CP-7420 (select FAME) (100 m long, 0.25 mm internal diameter and 0.25 µm in cyanopropyl). The H₂ flow (Carrier gas) was 1.2 mL/ min with 30 mL/ min of N₂ (make up); and 35 to 300 mL/ min for the H₂ and synthetic air. The injected volume was approximately 2.0 µl using Split 1: 80, being the injector temperatures and detector 220 and 230 °C, respectively; while the column was 165 °C for 10 min and high rate of 4 °C/ min until 235 °C and maintained for 8 min. The percentages were determined by integration of the peak areas for the Software Chronquest, version 5.0.

Analyses of variance and regression were carried out by statistic package Statistical Analysis System 9.1 [5].

III. RESULTS AND DISCUSSION

The diets in study do not promote significant effects on levels of myristic acids (C14:0) and palmitic acid (C16:0), but for stearic acid (C18:0), significant effects with an average of 254 g/ kg (Table 2). As reported by Scollan *et al.* [6], the predominant saturated fatty acids in beef are the C14:0, C16:0 and C18:0 (The C18:0 represents approximately 30% of total saturated fatty acids). Saturated fatty acids are correlated with plasma levels of cholesterol and promote higher LDL level (Low density lipoprotein), The C16:0 with less intensity than the C14:0. According Scollan *et al.* [6], the C18:0 is considered neutral in the plasma cholesterol level.

The increase in the concentration of oleic acid is highly desirable because, as reported by Mir *et al.* [7], this fatty acid is recognized for having hypocholesterolemic properties. The cows used in this study also showed a large concentration of this fatty acid, which can be related to increased activity of Δ⁹-desaturase enzyme in females, which according to Kazala *et al.* [8], acts in the conversion of myristic, palmitic and stearic acids

in their corresponding monounsaturated acids (n-9).

The behenic (22:0) and lignoceric fatty acids (24:0) were significant with mean values of 0.33 and 0.90 g/ kg respectively. There are two hypotheses that may explain the accumulation of these acids in the beef, whereas, with a high content of stearic acid, this in turn may have been processed in the rumen and synthesize acids (22:0) and (24:0), through the process of elongation (increase of the chain). The second possibility is related to the high content of erucic acid in the crambe crushed, which probably suffered the process of biohydrogenation in the rumen, resulting in behenic fatty acid (22:0).

Table 2 Profile and sum of fatty acids of tenderloin of cows Nellore (g/ kg) supplemented with crambe crushed in the diet

Fatty acids	Inclusion of crambe crushed (% DM)				SEM	P < Value ¹
	0	5	10	15		
C14:0	59.2	30.7	33.7	7.20	5.16	NS
C16:0	66.5	207	188	86.6	17.1	NS
C16:1	53.1	27.0	30.4	55.5	3.61	NS
C18:0	125 ^c	294 ^{ab}	319 ^a	278 ^b	21.3	*
C18:1n9c	0.03	0.40	0.20	0.08	0.04	NS
C18:1n9t	84.6	273	268	218	21.3	NS
C18:2n6c	46.6	16.1	15.4	34.1	3.66	NS
C18:2n6t	144	86.0	93.1	104	6.24	NS
C18:3n6	4.60	1.80	0.91	6.30	0.60	NS
C20:0	7.80	8.80	3.90	2.70	1.76	NS
C20:4n6	0.08	0.01	0.02	1.40	0.17	NS
C22:0	0.20 ^a	0.10 ^b	0.08 ^c	0.07 ^c	0.07	*
C22:1n9	3.40	4.70	2.50	12.4	1.10	NS
C23:0	0.01	-	-	0.02	0.003	NS
C24:0	0.20 ^c	0.50 ^b	0.40 ^b	2.10 ^a	0.21	*
Fatty acids	0	5	10	15	SEM	P < Value ¹
SFA	317 ^c	574 ^a	575 ^a	513 ^b	29.5	*

MUFA	158 ^b	313 ^a	306 ^a	323 ^a	19.3	*
PFA	228	114	119	164	12.2	NS
n-3	7.60	5.80	3.50	11.2	0.79	NS
n-6	21.1	10.7	11.5	15.1	1.14	NS
n-6/n-3	2.77	1.84	3.28	1.35	0.21	NS
PUFA/SFA	0.76	0.20	0.21	0.35	0.06	NS

SFA: Saturated fatty acids, MUFA: Monounsaturated fatty acids, PUFA: Polyunsaturated fatty acids. ¹Significance: * P < 0.05; ** P < 0.01; P < 0.0001; NS – not significant.

For the total saturated fatty acids (SFA) and monounsaturated (MUFA) significant effects with the inclusion of crambe crushed, **consequently, because of the increased** fatty acids (18:0), (C22:0) and (C24:0). The increase of monounsaturated fatty acids in the **meat** of the animal in study, when consumed is important for human health, because monounsaturated fatty acids, **e.g.** oleic acid, **have** effect on cholesterol levels, **as well as the** polyunsaturated, **e.g.** linoleic acid (C18:2), reduce serum LDL cholesterol levels.

According Enser *et al.* [9], the British Department of health considers minimum value for a healthy diet the ratio of 0.45 between polyunsaturated fatty acids and saturated fatty acids. The highest values for this ratio in this study were observed in the beef of animals finished with the control diet with average value of 0.76 (Table 2). The mean value obtained for the ratio PUFA/ SFA from animals fed diets with inclusion of crambe crushed was 0.25. However the crambe crushed gave higher values for saturated and monounsaturated fatty acids in the beef of Nellore cows, independent of concentration.

IV. CONCLUSION

Nellore cull cows finished on pasture, supplemented with crambe crushed replacing soybean meal in the transition period water-dry resulted in increase of saturated fatty acids, but not affecting the quality of the meat.

The inclusion of up to 15% of crambe crushed in the diet of cull cows caused a desirable fatty acid

profile, once the ratio MUFA/SFA showed acceptable values.

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