

EFFECT OF DIETARY WHOLE COTTONSEED VITAMIN E AND DAYS OF FINISHING ON SENSORY TRAITS OF MEAT FROM NELLORE BULLS

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Abstract – The whole cottonseed is a residue from agroindustry rich in polyunsaturated fatty acids able to provide healthy meat, however this residue may affect the flavor. Then, the objective of this study was to evaluate the effect of replacing corn with whole cottonseed (30%) with or without vitamin E (500 IU vitamin E/kg of DM) and the finishing period (83, 104 and 111) on sensory attributes of beef from Nellore bulls (3x3 factorial design, n=54). Samples were evaluated by 12 trained panelists. There was significant interaction between the factors studied for tenderness. Diet effect was observed for all sensory traits except for off-aroma. Meat obtained from bulls fed whole cottonseed (WCS, WCSE) provided the juiciest meat and the most intense aroma and flavor. Regarding off-flavor attribute, bulls fed C diet provided the most desirable meat. The addition of vitamin E did not positively or negatively affect the sensory attributes of meat from animals fed whole cottonseed regardless the length of finishing.

Key Words – antioxidant, lipids, meat traits.

I. INTRODUCTION

The use of residues from agroindustry for animal feeding is an economically viable alternative for diet costs savings. Among these residues, the whole cottonseed stands out in preparation for ruminants diets [1- 3]. The whole cottonseed has desirable proprieties such as high energy value and, provides increased polyunsaturated fatty

acids (PUFA) on meat and fat of animals. Recently, consumers are looking for healthy products and foods rich in PUFA that could increase product add value [4]. However, meat containing high amounts of unsaturated fatty acids (FA) is susceptible to oxidation and may produce undesirable odors and flavors which strongly reduce the acceptability of the beef by consumers [5].

Antioxidants can be defined as any substance that delays, prevents or removes oxidative damage to a target molecule [6]. Including vitamin E in animal feed reduced the lipid oxidation and improved the meat quality [7].

The objective of this study was to evaluate the effect of replacing corn with whole cottonseed (30%) with or without vitamin E and the finishing period on sensory attributes of beef from Nellore bulls.

II. MATERIALS AND METHODS

The study was conducted at the School of Veterinary Medicine and Animal Sciences, University of Sao Paulo, Pirassununga, Brazil and at Brazilian Agricultural Research Corporation (EMBRAPA) Southeast Livestock, Sao Carlos, Brazil.

A total of fifty four Nellore bulls, with approximately 350 kg of initial weight and 24 months of average age, were confined in pens, randomized in blocks according to initial body weight. The ration was offered once a day, *ad libitum*, and forage:concentrate ratio was 14:86.

Raw sugarcane bagasse was used as forage source and the concentrate mixture contained dry corn grain, citrus pulp and soybean meal. The following diets were used: control (C); inclusion of 30% (on diet DM basis) of whole cottonseed (WCS); inclusion of 30% (on diet DM basis) of whole cottonseed plus 500 IU of vitamin E/ kg DM basis on diet (tocopherol acetate) (WCSE).

Animals were slaughtered at 83, 104 and 111 days of feedlot, in the slaughterhouse school at University of Sao Paulo, Brazil, following the normal procedures of the Regulation of Industrial Inspection and Safety of Animal Products – RIISPOA [8]. After 24h cooling (around 0°C), a sample of 2.5 cm from *Longissimus thoracis et lumborum* muscle between the 12th-13th ribs, was collected and then vacuum packed, aged 14 days (around 2°C), identified and maintained frozen at -18°C for sensorial assessment.

Sensorial analysis was performed using sensory descriptive analysis. The steaks were cooked until a core temperature of 71°C and cut in 1.27 cm³. The samples were encoded with three digit number and provided one at a time to the tasters in accordance with the balancing of the samples [9]. Analysis was performed in individual booths, under controlled temperature and lighting conditions. Trained panelists evaluated each sample and recorded scores using nine-point scales ('tenderness' 1 = extremely tough; 9 = extremely tender, 'juiciness' 1 = extremely dry; 9 = extremely juicy, 'beef characteristic flavor' 1 = extremely bland; 9 = extremely intense, 'off-flavor' 1 = intense; 9 = none, 'beef characteristic aroma' 1 = extremely bland; 9 = extremely intense, 'off-aroma' 1 = intense; 9 = none)

A total of 12 panelists participated of the descriptive analysis, according to AMSA [10] and Kelly [11]. The data were collected electronically through FIZZ program. The results were analyzed applying a linear mixed model, using the MIXED procedure of SAS® (version 9.2), including the fixed effect of diet, slaughter time and the interaction between them, and the block random effect (panelist).

III. RESULTS AND DISCUSSION

There was interaction effect between diet and finishing period only for tenderness ($P < 0.01$). Beef obtained from treatments containing whole cottonseed (WCS and WCSE) were tenderer than the meat obtained from the control group (C). However, the meat obtained from WCSE diet was tenderer after the animals were finished for 111 days. The cattle fed with control (C) diet which remained more finishing periods presented increased beef tenderness (Table 1). Generally finishing feeding improves shear force values of meat [12, 13].

Table 1 –Least square means and standard errors for tenderness in *Longissimus thoracis et lumborum* muscle of Nellore bulls fed whole cottonseed and vitamin E over different finishing periods.

Diet x Finishing periods	Means	SE	
C	83days	4.59 ^e	0.24
	104days	6.04 ^d	0.27
	111 days	6.14 ^d	0.26
WCS	83 days	7.06 ^{abc}	0.28
	104 days	7.20 ^{ab}	0.27
	111 days	6.96 ^{abc}	0.26
WCSE	83 days	6.47 ^{cd}	0.28
	104 days	6.78 ^{bc}	0.26
	111 days	7.51 ^a	0.28

C, control; WCS, inclusion of 30% of WCS (on diet DM basis); WCSE, inclusion of 30% of WCS and 500 IU of vitamin E/ kg DM (on diet DM basis). Means followed by the same letter are not significantly different from each other, according to Tukey test at 5% probability.

Diet effect was significant for all sensory attributes studied except for off-aroma. On the other hand, finishing period was not significant for any of the sensory attributes studied (Table 2).

For beef characteristic aroma, the diet effect was significant ($P < 0.01$). Animals fed WCS provided meat with a more intense aroma (6.28), compared with the meat from C group (5.57). The meat obtained from C diet fed bulls did not differ from WCSE (5.93). Costa et al. [14]

reported that the addition of whole cottonseed in bovine diet negatively altered the aroma and flavor of the meat. There was a significant diet effect for the beef characteristic flavor and off-flavor ($P < 0.01$). For the beef characteristic flavor, the animals fed WCS and WCSE diets provided meat with a more intense flavor (6.07 and 5.87, respectively), differing from C diet (5.05). For off-flavor, where higher scores mean lower intensities, meat obtained from bulls fed C diet provided less intense flavor (7.45) and differed only from the WCS (6.49), while WCSE obtained intermediate values. Accordingly, Souza [15] also observed that Nellore cattle fed with 19% cottonseed showed beef with higher off-flavor compared to those containing soybean and sunflower seed. This author reported higher juiciness values in meat from animals fed whole cottonseed in comparison to other diets. In the present study, animals fed diets containing whole cottonseed also provided a juicier meat (5.74 and 5.75 for WCS and WCSE, respectively) in comparison to C diet (5.26).

Table 2 - Least square means and standard errors for characteristic aroma, off-aroma, characteristic flavor, off-flavor and juiciness of *Longissimus thoracis et lumborum* muscle of Nellore fed whole cottonseed and vitamin E.

Attribute	Diet			P value
	C	WCS	WCSE	
Beef Characteristic Aroma	5.57 ^b ±0.23	6.28 ^a ±0.24	5.93 ^{ab} ±0.24	<0.01
Off-Aroma	7.63 ±0.28	7.77 ±0.28	7.29 ±0.28	>0.05
Beef Characteristic Flavor	5.05 ^b ±0.24	6.07 ^a ±0.25	5.85 ^a ±0.25	<0.01
Off-Flavor	7.45 ^a ±0.32	6.49 ^b ±0.32	6.84 ^{ab} ±0.32	<0.01
Juiciness	5.26 ^b ±0.19	5.74 ^a ±0.19	5.75 ^a ±0.19	<0.05

C, control; WCS, inclusion of 30% of WCS (on diet DM basis); WCSE, inclusion of 30% of WCS and 500 IU of vitamin E/ kg DM (on diet DM basis). Means followed by the same letter are not significantly different from each other, according to Tukey test at 5% probability.

IV. CONCLUSION

In general, from the results obtained in the present study it could be concluded that beef obtained from bulls fed whole cottonseed was tenderer than beef obtained from C diet. However, tenderness was affected by the interaction of studied factors where the tenderer beef was obtained from bulls fed WCSE over 111 days. Vitamin E inclusion did not positively or negatively affect the sensory attributes, especially the attribute off-flavor associated to whole cottonseed fed animals.

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