SENSORY DESCRIPTIVE ANALYSIS AND ACCEPTANCE OF BEEF FROM ANIMALS FED YERBA MATE

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Abstract – Nowadays, consumers are seeking for healthier products and the use of natural antioxidants is an important tool for improving the oxidative stability of beef. However, the use of these products may affect sensory properties as aroma, flavour and tenderness. This study aimed to evaluate the sensory characteristics and acceptance of beef from animals fed with different levels of yerba mate (*Ilex paraguariensis* St. Hilaire). Characteristic beef aroma/flavour, strange aroma/flavour intensity, tenderness, juiciness, flavour acceptance, texture acceptance and overall acceptance were evaluated. Yerba mate supplement feeding positively affect tenderness and overall acceptance of beef, whereas flavour was not affected by the presence of yerba mate in the diet. Yerba mate may be used in the beef cattle diet yielding a tender meat without affecting negatively the beef sensory properties.

I. INTRODUCTION

Yerba mate (*Ilex paraguariensis,* St. Hilaire) is a native plant from South America, and is found in southern Brazil, northern Argentina, Paraguay and Uruguay. This product can be consumed as a beverage and has several industrial uses, as a food ingredient in ice creams, gellies and in the chemical industry (paintings, soap, medicines and deodorants). Yerba mate is rich in phenolic compounds (mainly chlorogenic acids and its derivatives), and alkaloids like the methyl xanthines derivatives [1, 2, 3, 4]. It has been shown to present antimicrobial [5, 6, 7], antioxidant [4, 8 ,9] and anti-inflammatory [10] properties. Yerba mate extract has been often used in studies aiming to improve the oxidative stability of poultry meat [11]. As there is a lack of studies about the oxidative stability and quality of beef products from animals fed with a diet containing yerba mate, herein we report the sensory characteristics and acceptance of beef from animals fed with different levels of yerba mate in the diet.

II. MATERIALS AND METHODS

Beef from forty-eight Nellore steers with an average age of 21 months and an initial weight of 419 kg were individually fed during 94 days with the same base diet, differing by yerba mate levels (0%, 0.5%, 1.0 and 1.5% w/w). Diets were composed of corn silage and concentrate (60:40 w/w) with 11% crude protein and 72% of total digestible nutrients. Diets were balanced using 0%, 0.5%, 1.0 and 1.5% w/w of Kaolinite (kaolin), an inert ingredient. Animals were shipped the day before the slaughter to a commercial abattoir and held overnight with access to water. Carcasses were chilled overnight at 2°C. At 24 hours post mortem, the left half-carcass was cut between the 12 and 13th rib and 2.5 cm steaks were collected for sensory analyses. Steaks for sensory evaluation were vacuum-packed and then stored at -20°C. Before the sensory analysis, samples were placed in a refrigerator at 5°C overnight and prior to the analysis, the steaks for each type of analysis were removed from the refrigerator and cooked according to the test. For descriptive analysis, five steaks per treatment were collected for evaluation. The samples were cooked in a Tedesco combined oven model TC 06 (Tedesco, Caixas do Sul, RS, Brasil) at 170°C, until reach an internal temperature of 75°C. For sensory acceptance, a pool of samples were made of steaks from ten animals of each combination and then salted with 1g of salt, pan-fried with soybean oil until reach an internal temperature of 75°C and cut in the same way of the descriptive analysis. For the descriptive analysis, each sample was randomly assigned to a ten-member trained taste panel. The samples for each panellist were presented in a

balanced design assigned by Fizz Software version 2.41 (Biosystemes, Couternon, France). Eight samples were evaluated per session. Attribute ratings were electronically collected using nine point descriptive scales for beef characteristic aroma/flavour (1= extremely bland; 9= extremely intense), strange aroma/flavour (1= extremely intense; 9= none), tenderness (1=extremely tough; 9= extremely tender) and juiciness (1=extremely dry; 9= extremely juicy). For sensory acceptance, samples were randomly assigned to 100 non-trained panelists, where 2 traits (control and 1.5% mate) were analyzed. Attribute ratings were collected using nine- point hedonic scales for flavor, texture and overall acceptance (1 = dislike extremely; 9 = like extremely) The experimental design was completely randomized with 4 treatments and 12 replicates, with diet as the fixed factor. The data were analyzed by ANOVA by XLSTAT software [12].

III. RESULTS AND DISCUSSION

Results from sensory descriptive analysis are shown in Table 1. Characteristic beef aroma and tenderness attributes were clearly affected by the animal diet. The control sample showed the highest value ($p<0.05$) of characteristic beef aroma, but no difference in the characteristic beef flavor nor strange aroma and flavor attributes were found. Even though it was expected that yerba mate would affect beef aroma and flavor, the sensory analysis shown that at the significant level ($p=0.05$) no difference could be noticed. The addition of yerba mate in the animal diet indeed affected positively the beef tenderness, with the control sample being less tender, especially compared to the beef from animals fed with yerba mate at 0.5% m/m in the diet. Table 2 contains the sensory acceptance score results. Flavor acceptance was not affected by animal feeding with yerba mate. However, in relation to texture (tenderness) and overall acceptance, the beef from animals supplemented with yerba mate shown to be more accepted probably due to its better tenderness. The use of yerba mate as an antioxidant in meat may has been shown to inhibit lipid and protein oxidation. Protein oxidation as the cross-linking of myofibrillar proteins may affect tenderness [13] and from that we could infer that bioactive compounds from yerba mate or their ruminal metabolites could be transferred to the muscle tissue improving its redox status and preventing protein oxidation.

Table 1. Sensory descriptive analysis of meat from animals fed with different levels of yerba mate in the diet

	Yerba mate levels (%)				s.e.m.	*P*
Attributes[1]	none	0.5	1.0	1.5		value
Characteristic beef aroma	6.5[b]	6.0[ab]	6.0[ab]	5.9[a]	0.258	**0.049**
Strange aroma intensity	8.0	7.8	7.9	7.8	0.291	0.913
Characteristic beef flavour	6.1	5.9	5.8	5.5	0.258	0.146
Strange flavour intensity (off-flavour)	7.6	7.6	7.7	7.6	0.309	0.959
Tenderness	4.0[a]	5.0[b]	4.4[ab]	4.6[ab]	0.315	**0.020**
Juiciness	5.0	5.2	5.4	5.1	0.271	0.365

[1]beef characteristic aroma/flavour (1 = extremely bland; 9 = extremely intense), strange aroma/flavour (1 = extremely intense, 9 = none), tenderness (1 = extremely tough; 9 = extremely tender) and juiciness (1 = extremely dry; 9 = extremely juicy).
[a,b] Mean value in the same row with different superscripts are significantly different ($P<0.05$); s.e.m., standard error for the mean value.

Table 2. Sensory acceptance of meat from animals fed with diet containing different levels of yerba mate

	Yerba mate level			
Acceptance Attributes	none	1.5%	s.e.m.	*P* value
Flavour	7.1	7.3	0.217	0.275
Texture	6.0[a]	6.8[b]	0.261	**0.002**
Overall acceptance	6.6[a]	7.2[b]	0.216	**0.018**

[a,b]Mean value in the same row with different superscripts are significantly different ($P<0.05$); s.e.m., standard error for the mean value.

In Figure 1, the principal component analysis shows a clear separation and clustering among samples of beef from animals fed with diet containing different levels of yerba mate. The studied sensory attributes explained 91.92% of the variation among the samples. Characteristic aroma and flavour were closely related to the control sample and tenderness related closely to the beef from animals supplemented with 0.5% m/m of yerba mate.

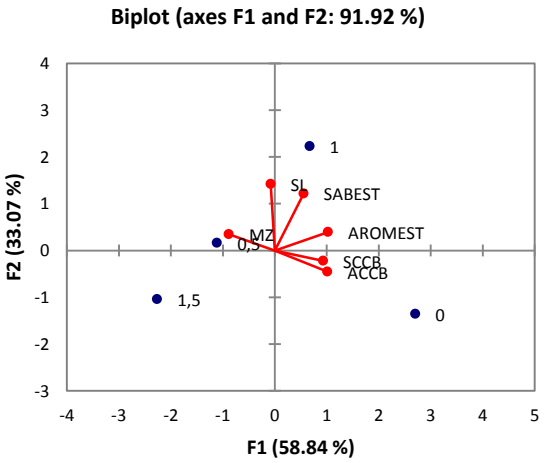

Figure 1. Principal component analysis of the sensory attributes and studied traits. ACCB= Characteristic beef aroma; AROMEST= Strange aroma intensity; SCCB= Characteristic beef flavor; SABEST= Strange flavor intensity (off-flavor); MZ= Tenderness; SL= Juiciness

IV. CONCLUSION

Beef from animals fed with diet containg different levels of yerba mate were more tender and were more accepted by consumers. Other sensory attributes such as aroma and flavour were not affected by the ruminant diet. Yerba mate may be used in the beef cattle diet without affecting negatively the beef sensory properties and provide a tender meat.

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