EFFECT OF DIET ON SENSORY CHARACTERISTICS AND ACCEPTANCE OF BEEF FROM CROSSBRED ANIMALS

Maria Lígia P. da Silva[1], Renata T. Nassu[2], Alexandre Berndt[2], Rymer R. Tullio[2] and Maurício M. de Alencar[2,3]

[1] São Paulo State University, Jaboticabal, SP, Brazil
[2] Embrapa Southeast Livestock, São Carlos, São Paulo, Brazil
[3] CNPq Researcher
*renata.nassu@embrapa.br

Abstract – Sensory attributes of beef are very important from consumer's point of view, mainly regarding to its tenderness and flavour. Crossbreeding is an alternative for obtaining high quality meat. The combination of the use of these animals and different diets can improve meat quality. This study aimed to evaluate sensory characteristics and acceptance of crossbred young bulls, the offspring of Charolais or Hereford bulls and ½ Angus x ½ Nelore or ½ Simmental x ½ Nelore cows. Characteristic as beef aroma/flavour, strange aroma/flavour intensity, tenderness, juiciness, flavour acceptance, texture acceptance and overall acceptance were evaluated. Beef from animals fed with a more energetic diet (diet A) was more tender. Other sensory attributes such as aroma and flavour were not affected by the studied effects.

I. INTRODUCTION

Sensory characteristics as colour, tenderness, aroma/flavour and juiciness are very important for consumers. Many factors can affect these attributes such as breed, age, diet, live weight, sex as well as slaughter conditions, meat ageing and cooking process [1]. In Brazil, ~80% of animals are originated from *Bos indicus,* which in general show less tender meat if comparing to *Bos taurus* [2]. The use of tropical climate adapted *Bos taurus* breeds without losing adaptation to tropical and subtropical climates is an alternative to produce beef to satisfy both consumers and retailers. Crossbreeding *Bos indicus* with *Bos Taurus* is an alternative for increase meat quality, mainly sensory characteristics. The combination of the use of these animals and different diets can improve meat quality. Lipids have been used to supplement ruminants´ diet and its effect on ruminal fermentation is well known [3], as the effect on growth performance, carcass characteristics and change in saturated fatty acid composition in beef and milk [4,5, 6]. However, there are few studies involving beef sensory characteristics and acceptance as affected by these diets. The aim of this study was to evaluate sensory descriptive analysis and acceptance of crossbred animals fed two different diets.

II. MATERIALS AND METHODS

Beef of young bulls from crosses of Charolais or Hereford bulls and ½Angus x ½ Nelore or ½ Simmental x ½ Nelore cows were randomly assigned to two different diets - A and B Within the same diet, it was changed from A1 to A2 and B1 to B2 when females and males reached 330kg and 380 kg respectively. Ration formulations are shown in Table 1. Rations were fed *ad libitum* in a total of 118 days. Average age at slaughter was 12 months. Animals were slaughtered when reached 5 mm of fat thickness estimated by ultrasound measurements. After slaughtering the animals in a commercial abattoir, carcasses were chilled overnight at 2°C. At 24 hours post mortem, the left half-carcass was cut between the 12th and 13th ribs and 2.5 cm steaks were removed for sensory descriptive analysis and for acceptance, vacuum-packed and frozen. Steaks for ageing were vacuum-packed and maintained at 1-2°C for 28 days and analyzed for the same parameters. Beef steaks from five animals of each combination of breed of sire, diet and ageing time were used for the sensory analysis and ten animals for the acceptance. The day before the sensory analyses and acceptance sessions, they were placed in a refrigerator at 5°C overnight. The following day (day of sensory analyses), steaks were cooked in a Tedesco combined oven, model TC 06 (Tedesco, Caxias do Sul, RS, Brasil), at 170°C, until reaching an internal temperature of 75°C. Each steak was cut into 1.5 cm of side cubes.

Table 1 Composition of rations (% dry matter).

	Diets			
	A1	A2	B1	B2
Corn silage	65.0	45.0	68.0	50.0
Ground corn grain	18.0	26.8	12.0	32.8
Wheat mea	13.5	5.0	3.5	8.0
Soybean meal	6.0	5.0	15.0	7.0
Limestone	0.5	0.7	0.5	0.7
Mineral supplement	1.0	1.0	1.0	1.0
Urea		0.5		0.5
Citrus pulp		8.0		
Corn gluten	6.0	3.0		
Protected fat		5.0		
Concentrate %	35.0	55.0	32.0	50.0

A1 and B1=initial diets, for growth
A2 and B2 = finishing diets

For sensory acceptance, 1g of salt was added to the steaks, which were fried with soybean oil, until reaching an internal temperature of 75°C and cut in the same way of the descriptive analyses. For the descriptive analyses, 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 panellists, divided into four different sessions when 2 traits were analyzed. The attribute ratings were collected using nine- point hedonic scales for flavour, texture and overall acceptance (1 = dislike extremely; 9 = like extremely). The experimental design was completely randomized, with breed of sire, diet and meat ageing as fixed factors. The proposed model was analyzed by XLSTAT software [7].

III. RESULTS AND DISCUSSION

Results of analyses of variance (ANOVA) for descriptive analyses and acceptance are shown in Tables 2 and 3, respectively.

Table 2. Analyses of variance for descriptive analyses sensory attributes

	Sum of squares					
Fixed effects	**CBA[1]**	**SAI[2]**	**CBF[3]**	**SFI[4]**	**Tend[5]**	**Juic[6]**
Diet	1.976	0.201	0.003	6.622	19.489*	16.857
B[7]	4.674	20.571	0.529	14.642	47.785**	12.216
T[8]	52.880	1.193	4.614	48.472**	562.572***	0.206
Diet*B	0.678	3.372	6.466	0.006	18.190*	3.851
Diet*T	6.273	0.079	2.390	0.771	0.166	0.127
B*T	0.087	0.344	10.704	17.100*	5.648	0.054
R²	0.016	0.011	0.007	0.032	0.180	0.013
Error	5.341	3.076	4.661	3.853	3.900	3.515
SD[9]	2.319	1.756	2.157	1.986	2.171	1.879
s.e.[10]	0.342	0.259	0.319	0.290	0.292	0.277

[1]Characteristic beef aroma, [2]strange aroma intensity, [3]Characteristic beef flavour, [4]Strange flavour intensity. [5]Tenderness, [6]Juiciness, [7]Breed of sires; [8]Ageing time; [9]SD=Standard deviation; [10]s.e.=standard error ;*p<0.05; **p<0.01; ***p<0.001

Table 3. Analysis of variance for sensory acceptance attributes

	Sum of squares		
Fixed effects	**Flavour**	**Texture**	**Overall Acceptance**
Diet	5.982	88.347***	44.804***
B[1]	0.569	19.517**	1.868
T[2]	1.279	31.472**	8.333
Diet*B	1.179	8.443	5.402
Diet*T	18.849	28.175**	28.411**
B*T	6.344	36.243**	24.450**
R²	0.018	0.081	0.057
Error	2.216	2.908	2.261
SD[3]	1.497	1.772	1.543
s.e.[4]	0.179	0.206	0.182

[1]Breed of sire and [2]Ageing time; [3]SD=Standard deviation; [4]s.e=standard error ;*p<0.05; **p<0.01; ***p<0.001

Diet, breed of sire and ageing time affected both sensory descriptive tenderness and texture acceptance (p<0.05). Diet had an effect (p<0.05) on overall acceptance and ageing time on strange flavour intensity. Flavour acceptance was not affected by any studied effect (p>0.05), as well as characteristic beef aroma/flavour, strange aroma intensity and juiciness. Double interactions between breed of sire x ageing time were found for strange flavour intensity, texture and overall acceptance. A diet and ageing time interaction was also found for texture and overall acceptance and tenderness was affected by a diet x breed of sire interaction (p<0.05) (Figure 1).
Sensory attributes mean values for characteristic beef aroma, strange aroma intensity, characteristic beef flavour, juiciness and flavour acceptance are shown in Table 4. For these

attributes, there was no significant difference (p>0.05). Although it was expected that high-energy diets provide meat with more intense beefy flavour [8], it was not observed in this study.

Table 4. Mean values of descriptive and acceptance sensory attributes of meat from animals fed two different diets.

	Attributes				
	CBA[1]	SAI[2]	CBF[3]	Juic[4]	Flavour acceptance
Diet					
Diet - A	5.7	8.0	5.2	5.9	7.4
Diet - B	5.6	8.0	5.2	5.6	7.3
B[5]					
Charolais	5.7	7.8	5.3	5.6	7.3
Hereford	5.6	8.2	5.2	5.9	7.6
Aging time					
0 day	5.9[a]	8.0	5.3	5.8	7.3
28 days	5.4[b]	8.0	5.2	5.7	7.4

[1]Characteristic beef aroma. [2]strange aroma intensity. [3]Characteristic beef flavour. [4]juiciness and [5]B=Breed of sire.
[ab]Mean values in the same row with different superscripts are significantly different (P<0.05).

Results for interactions between breed of sire and ageing time; and for diet x ageing time for texture and overall acceptance are shown in Table 5 and 6 respectively. It can be seen that 28-day aged beef from Charolais bulls was the most accepted (Table 5) and 0-day beef combined with diet B was the less accepted (Table 6). At 28 days of ageing, independently of diet, samples were well accepted, but for the 0-day, diet A showed better results and not significantly different (p>0.05) from the 28-day samples.

Table 5. Mean values of acceptance sensory attributes of meat from animals fed two different diets, according to breed of sire x ageing time interaction.

	Attributes			
	Texture		Overall Acceptance	
B[1]	**0-day**	**28-days**	**0-day**	**28-days**
Charolais	6.9[b]	7.8[a]	7.0[b]	7.6[a]
Hereford	7.1[b]	7.0[b]	7.3[b]	7.1[b]

[1]B=Breed of sire
[ab]Mean values in the same attribute description with different superscripts are significantly different (P<0.05).

Table 6. Mean values of acceptance sensory attributes of meat from animals fed two different diets, according to diet x ageing time interaction.

	Attributes			
	Texture		Overall Acceptance	
	0-day	**28-days**	**0-day**	**28-days**
Diet A	7.5[a]	7.5[a]	7.6[a]	7.4[a]
Diet B	6.5[b]	7.3[a]	6.7[b]	7.3[a]

[ab]Mean values in the same attribute description with different superscripts are significantly different (P<0.05).

For tenderness descriptive attribute, difference between diets occurred only for Charolais sired animals, when diet B fed animals showed a less tender meat Charolais sire (Figure 1). For strange flavour intensity, at 28-day ageing time, Charolais bull genetic group showed a different value for this attribute (p<0.05) (Figure 2). At 0 day ageing time, there was no difference (p>0.05) between Charolais and Hereford bulls. Ageing generally is a process that provides non-characteristic or undesirable aroma and flavour to beef, due to formation of various flavour compounds [9]

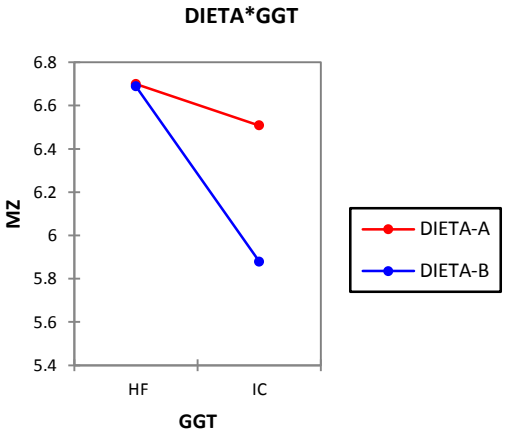

Figure 1. Interaction between diet and breed of sire. Diet (A/B) = Diet (A/B); B=Breed of sire; MZ = Tenderness; HF = Hereford and IC = Charolais.

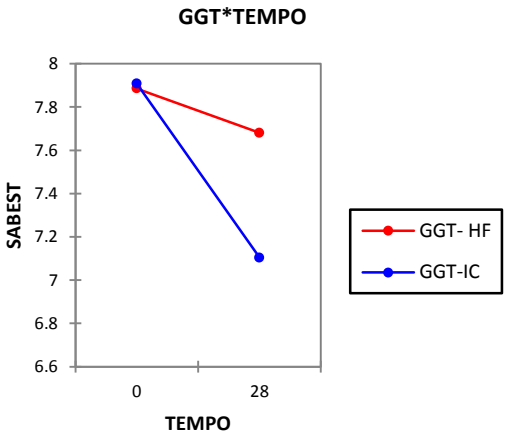

Figure 2. Interaction between breed of sire and aging time. Time = Meat Aging; B=Breed of sire; SABEST = Strange Flavour Intensity; HF = Hereford and IC = Charolais.

IV. CONCLUSION

Aroma and flavour attributes, except strange flavour attribute, were not affected by diet, breed of sire and ageing. On the other side, texture (tenderness) and overall acceptance were affected by ageing time interactions with diet and breed of sire. Beef aged 28 days from Charolais bulls was the most accepted. Higher energy diets provided a tenderer meat.

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