Relationship between off-flavour descriptors and flavour scores in beef from cattle raised on natural pasture

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Abstract

The current study determined the relationship between off-flavour descriptors and flavour scores in beef aged for two and 21 days from Nguni, Bonsmara and Angus steers. Fifteen steers each of Bonsmara and Angus and 25 steers of Nguni were slaughtered at 18 months. The *m. longissimus thoracis et lumborum* was sampled post mortem for flavour evaluation. There were associations between off-flavour descriptors and off-flavour scores, off-flavour descriptors and aroma scores. There were no associations between beef from the three cattle breeds and off-flavour descriptors, flavour scores and off-flavour descriptors, ageing periods and off-flavour descriptors. It can be concluded that off-flavour description is uniform across breeds and ageing periods. Furthermore, off-flavour description is related to off-flavour scores and aroma scores.

Introduction

Flavour is one of the components of sensory evaluation that affect beef acceptability by consumers. It is a combination of several chemical interactions involving proteins, lipids and carbohydrates (Spanier *et al.*, 1997) and is a very complex attribute of meat palatability (Calkins & Hodgen, 2007). Flavor consists of taste-active compounds, flavor enhancers and aroma components with over 880 compounds presently identified in cooked beef alone (Stelzleni & Johnson, 2008). The aroma compounds in meat are generated from precursors during cooking, mainly from lipid oxidation and degradation (Stelzleni & Johnson, 2008), especially the thermal oxidation of long-chain fatty acids (Farmer & Patterson, 1991).

In lean meat where intramuscular triacylglycerols and phospholipids are the dominant forms of lipids (Stelzleni & Johnson, 2008), thermal oxidation of long-chain fatty acids occurs, leading to undesirable flavor formation (Mottram, 1998). Therefore flavour evaluation should include off-flavour and its descriptors. Off-flavours of beef include bloody/livery, metallic, grassy, sour, cooked vegetable and animal tastes. Off-flavour development in beef is affected by several factors which include nutrition, animal species, sex of the animal, and age of the animal, breed, ageing of meat, muscle type, cooking method and type of storage (Spanier *et al*., 1997).

Off-flavours develop with ageing (Calkins & Hodgen, 2007) because meat nitrogen-containing compounds can be formed by natural degradation occurring during ageing, with some of them possessing a variety of meat notes which can partially explain the increasing odour. The rest of the odour could be due to many volatile compounds, which have been described as components of cooked meat (Farmer & Patterson, 1991), although their influence on the odour is not fully understood. Stelzleni & Johnson (2008) proposed that when examining factors that impact off-flavour production it may be more beneficial to look at the total number of samples that were detected with off-flavors rather than the sensory off-flavor score.

Spanier *et al*. (1997) determined relationships between treatments, sensory, instrumental and chemical descriptors in Brangus steers. However, little has been done on the relationships between breed, ageing, flavour and off-flavour descriptors in cattle raised on natural pastures. The objective of the current study was, therefore, to determine the relationships between off-flavour descriptors, and breed, ageing, flavour scores, aroma scores and off-flavour scores in beef from cattle raised under natural grazing conditions.

Materials and methods

The study was conducted at the University of Fort Hare farm. Fifteen steers each of the Bonsmara and Angus and 25 steers of Nguni breed slaughtered at 18 months of age. The m. *longissimus thoracis et lumborum* (LTL) was sampled for sensory analyses (ISO 8586-1, 1993). On an eight-point rating scale, assessments were made on beef aroma intensity, overall flavour intensity and off-typical flavour intensity.

Chi-square tests (SAS, 2000) were used to test for associations between breed and off-flavour descriptors, ageing period and descriptors, flavour scores and off-flavour descriptors, aroma scores and off-flavour descriptors, and off-flavour scores and off-flavour descriptors.

Results and discussion

The most frequent off-flavour descriptors were bloody/livery and sour. The frequency of off-flavour descriptors did not ($P > 0.05$) depend on breed. While there was an association ($P < 0.05$) between the off-flavour scores and off-flavour descriptors (Table 1), overall flavour scores was independent ($P > 0.05$) of off-flavour descriptors. There was an association ($P < 0.05$) between aroma scores and off-flavour descriptors. The frequency of off-flavour descriptors was independent ($P > 0.05$) of the ageing period.

Table 1. Frequency of off-flavour scores in different off-flavour descriptors

Off-flavour descriptor	Frequency (%) of off-flavour score						Total	P value
	1	2	3	4	5	6		
Animal	0	1.9	1.0	0.5	0	0	3.4	<0.0001
Bloody/Livery	0.3	29.7	4.4	0.2	0	0	34.6	
Cooked Vegetable	0.2	13.7	1.0	0	0	0	14.9	
Glassy	0	4.8	0.9	0.2	0	0	5.8	
Metallic	0	9.0	2.4	0	0.2	0.2	11.8	
Sour	0	16.0	5.1	1.4	0.3	0	22.9	
Unpleasant	0	4.9	1.9	0	0	0	6.7	
Total	0.5	79.9	16.7	2.2	0.5	0.2	100	

Breed is not necessarily an important factor in determining the flavour of beef (Muchenje *et al*., 2008). Factors such as nutrition (Stelzleni & Johnson, 2008), sex, age and species of the animal are more important. The association between flavour scores and off-flavour descriptors would be expected since the off-flavour intensity is likely to vary depending on the off-flavour descriptor. In the current study, the flavour intensity of 'bloody/livery' and 'cooked vegetable' taste was indicated as generally high while that of 'animal', 'sour' and 'grassy' was spread to more scores. Flavour scores and off-flavour descriptors maybe independent of each other because of the complex nature of flavour (Calkins & Hodgen, 2007). There are obvious differences in terms of aroma, for example, between something sensed as 'bloody/livery' and 'cooked vegetable'. The 'blood/livery' descriptor had more favourable aroma scores as compared to the 'animal', 'sour' and 'cooked vegetable' descriptors.

An absence of an association between ageing and sensory descriptors would be expected since particular sensory descriptors would be expected after a certain ageing period in beef. As off-flavours develop with ageing (Calkins & Hodgen, 2007), one would expect more concentrations of particular off-flavour descriptors after ageing for 21 days than after ageing for two days. Stelzleni & Johnson (2008) and Sapp *et al*. (1999) reported that ageing did not affect off-flavour detection. Melton (1983) reported more researchers found that postmortem aging increased off-flavor production in grass-fed cattle when compared to grain-fed cattle.

Conclusions

Off-flavour description is uniform across breeds and ageing periods. Flavour scores are independent of off-flavour descriptors while off-flavour description is related to off-flavour scores and aroma scores. This implies that when performing off-flavour evaluations flavour description should be included in addition to off-flavour scores.

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