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EFFECT OF CONFORMATION AND FATNESS SCORE ON VOLATILE COMPOUNDS PROFILE

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Introduction

Labels and quality marks have arisen around breeding of local breeds. They have to, among other objectives, characterise marked products to fix prices according to a described quality. The effect of volatile compounds on the sensory acceptability of meat is very important. Raw beef contains a lot of precursors that during cooking will contribute to meat aroma and flavour (Mottram and Edwards, 1993). In Spain, beef carcass prices are fixed according the conformation and fatness score of the European beef grading system (OJEU, 1991). So, to characterise the products of a local breed and to link these characteristics to an economic value, it would be necessary to describe the differences among the conformation and fatness scores.

Objectives

The objectives of this work were to describe the volatile compound profile of cooked beef from *Pirenaica*, a Spanish cattle breed, bulls and to study the differences on volatile compounds among conformation and fatness scores.

Methodology

Forty carcasses from yearling bulls of *Pirenaica* breed were graded for fatness and conformation according to the European beef grading system (OJEU, 1991). After ageing *l. dorsi* (12^{th} rib) samples for 24 hours, they were wrapped in aluminium foil and broiled at 180ºC until achieve 70ºC of internal temperature. Volatile compounds were extracted by purge and trap and tentatively identified by gas chromatography with mass spectrometry. The relative percentage of area of each volatile compound was calculated to describe volatile compounds profile.

The discriminant analysis was accomplished with volatile compounds detected in all of the studied samples, to find out which of them contributed to a greater extent to separate conformation or fatness scores. In view of the assignment of the carcasses across grades (67% of carcasses were graded as U^0 in the conformation scale and 65% as 2^0 in the fatness scale) it was decided to group the carcasses to create groups which provide enough number of carcasses for meaningful statistical analysis. The carcasses with higher and lower conformation scores than U^0 were grouped to create groups of high and low conformation, and the carcasses assigned exactly to conformation U^0 was the group of average conformation. Similarly, carcasses that scored below 2^0 for fatness scores were grouped as low fatness, carcasses score above 2^0 as high fatness, and carcasses that scored exactly 2^0 as average fatness score.

Results & Discussion

Thirty volatile compounds were tentatively identified from the headspace of the beef samples. The most abundant detected compounds by their relative percentage of area were aliphatic ketones (50.8%), followed by aliphatic aldehydes (26.96%), aliphatic alcohols (12.8%), aliphatic hydrocarbons (6.3%), benzenoid compounds (1.9%), sulphur compounds (0.9%), and alicyclic hydrocarbons (0.3%) (Figure 1). Hydrocarbons, aldehydes, alcohols, ketones and bezenoid compounds are originated from lipid thermal oxidation (Mottram & Edwards, 1983; Fogerty et al., 1990; Bolyston et al., 1996). The extensive presence of lipid oxidation-derived products and the sparse presence of Maillard reaction-derived products could be due to the mild cooking conditions that led to a medium cooked meat. (Mottram, 1998). Among detected volatile compounds the aliphatic ketone 2-propanone showed the highest RPA (RPA=43.7%), followed by the aliphatic aldehide hexanal (17.8%). Only 8 volatile compounds were detected in all the analysed samples: the aliphatic hydrocarbons 3-octene and 2,2,4,6,6-pentamethylheptane; the aliphatic aldehydes ethanal and hexanal; the aliphatic ketones 2-propanone and 2-butanone; the sulphur compound methanethiol and the aliphatic alcohol tioethanol.

When defining groups by conformation score there were obtained two canonical discriminant functions that classified correctly 67.5% of the cases (Table 1; Figures 1A). Ethanal, hexanal, 2-propanone and thioethanol contributed to separate average conformation score against low and high conformation score. Function 2 separated extreme conformation scores on the basis of 3-octene, 2,2,4,6,6-pentamethylheptane, 2-butanone and methanethiol. When defining groups by fatness scores, there were obtained two canonical discriminant functions that classified correctly 67.5% of the cases (Table 1; Figures 2B). Function 1 separated average fatness score against low and high fatness score on the basis of 2,2,4,6,6-pentamethylheptane, ethanal, 2-propanone and thioethanol. Function 2 separated low against high fatness score on the basis of 3-octene, hexanal, 2-butanone and methanethiol.

There were three volatile compounds (3-octene, 2-butanone and methanethiol) that contributed to separate extreme conformation and fatness scores. Those carcasses scored as $U^0 2^0$, which were the most abundant carcasses in the current research, would be characterised by their higher content of 2-propanone and thioethanol.

Conclusions

Thirty volatile compounds were tentatively identified in broiled beef from yearling bulls of *Pirenaica* breed, with an extensive presence of lipid oxidation-derived products. Beef carcasses of Pirenaica breed currently traded would be relatively homogeneous: Most of the carcasses were graded as U^0 in the conformation scale and as 2^0 in the fatness scale. The animals $U^0 2^0$ would be characterised by their high content of 2-propanone and thioethanol.

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Tables and Figures

Table 1. Correlation coefficients between canonical discriminant functions and volatile compounds on groups defined by conformation and fatness score

	Conformation score		Fatness score	
Percentage of explained variability	67.2%	32.8%	87.9%	12.1%
	0.45	0.54*	0.10	0.59
	0.36	0.37*	0.28*	0.13
	0.25*	0.04	0.67*	0.39
	0.25*	0.13	-0.07	0.49*
	0.51*	-0.03	-0.24*	-0.21
	0.02	0.53*	0.13	-0.23*
	0.05	0.15*	-0.06	0.09*
	0.17*	0.08	-0.12	-0.03

*: denotes largest absolute correlation between each variable and any discriminant function

Figure 1. Percentage of area counts of volatile compounds according to their chemical nature

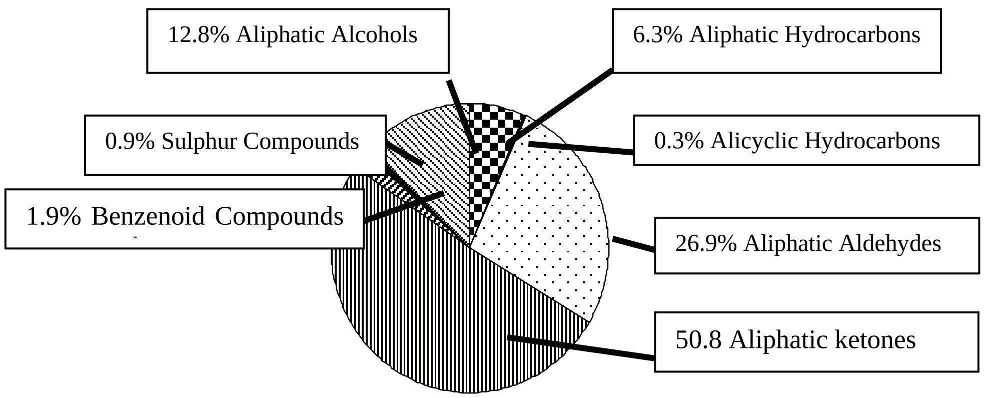

Figure 2. Separation of conformation (A) and fatness (B) groups applying the discriminant analysis to volatile compounds of the *l. dorsi* of beef of Pirenaica young bulls