

Flavour and off-flavours in lamb

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There is a trend across Europe towards using entire rather than castrated males for meat production both for welfare and efficiency reasons. The grilled loin from entire and castrate males, six diets and two breeds was subjected to sensory profiling. Results show an effect of both breed and diet on flavour, but fewer effects of gender. However, a few individual animals received elevated scores for some off-flavours. The incidence of these off-flavours was affected by diet. Volatile analysis by headspace concentration and GC-MS-O has indicated the presence of compounds associated with off odours.

Key Words – lamb, meat, flavour, off-flavour.

I. INTRODUCTION

The meat industry in Ireland perceives that ram lamb has a less desirable flavour than that from castrates and females [1]. However, across Europe, there is a move to produce lamb meat from entire males rather than castrates for welfare reasons and because they are more efficient [2]. Research on off-flavours in sheep meat has identified a number of compounds that can contribute to the characteristic flavour of lamb and/or off-flavours [3,4]. These include medium chain branched fatty acids, carboxylic acids, aldehydes, ketones and sulphur-containing compounds.

II. MATERIALS AND METHODS

A trial was conducted using 144 lambs to determine the role of gender (entire male or castrate), breed (Suffolk cross and Blackface-Swaledale cross) and diet (concentrate, grass or clover silage, grazed grass, rape or stubble turnip) on off-flavours in ram lambs (six animals per treatment). Lambs were slaughtered at 8-10 months old and the loin subjected to sensory profiling and volatile analysis by headspace concentration and GC-MS-O using three assessors. Sensory analysis was carried out using eight trained assessors. The panellists generated descriptors to describe a number of attributes for aroma, texture, flavour and aftertaste. The loin was grilled with fat (but not bone) in a Rational oven. Each panellist assessed meat from all animals. Each sample was presented with fat and the assessor asked to assess the aroma of the fat before evaluating the lean meat. Attributes were scored on a line scale of 1-100. The results were statistically analysed using linear mixed methodology, using restricted maximum likelihood (REML) estimation. A total of 40 samples were selected for GC-MS-O, based on sensory results. These were from four diets (grass, turnip, concentrate and grass silage), two breeds and five animals from each treatment. Volatile analysis was conducted by headspace concentration and collection of volatiles on to a Tenax trap, followed by GC-MC-O analysis by three assessors, using a Markes Unity 1 Thermal Desorption Unit coupled to an Agilent 6890N gas chromatograph with a 5975B Inert XL, MSD mass selective detector. Separation was on a Zebron, ZB-5, 30m, I.D. 0.32mm, 0.5µm column.

III. RESULTS AND DISCUSSION

Analysis of the sensory results showed a number of attributes to be statistically significant. Statistically significant results for flavour and aroma-related attributes are shown in Table 1. The results showed that there were effects of breed and diet on some aroma attributes, but fewer effects of gender. There were no significant effects of any of the treatments on flavour attributes and there is no evidence of an overall adverse effect of entire male lambs on the aroma or flavour of the meat.

Examination of the data for individual panellists showed that not all were sensitive to all odours. Of the eight panelists, three assessors differentiated between samples for farmyard aroma, piggy aroma and sour aroma, consistently reporting elevated scores for these characteristics in meat from some animals (Table 2). The incidence of these off-flavours was affected by breed, gender and diet.

GC-MS-O analysis indicates that many odours contribute to the overall lamb aroma, including some reputed to cause off-flavours. These include *p*-cresol, 4-methyloctanoic acid and 4-ethyloctanoic acid. Studies are ongoing to elucidate the chemical cause of the enhanced off-flavours and odours in the lambs identified in Table 2.

Table 1. Significant effects of gender, diet and breed on flavour-related attributes in grilled lamb

	Gender ^a		Diet ^b						Breed ^c		SED	Sig ^d
	M	C	Grass	Rape	Turnip	Conc	Gsil	CSil	SBx	Sfx		
<i>Aroma of fat</i>												
Crackling	45.3	47.0	45.7	48.9	50.3	44.9	44.2	42.9	45.4	46.9	2.75	Diet: ***, 5.49 G.D.B: *
Roasted	42.5	43.8	42.2	43.2	44.4	43.7	43.7	41.7	42.2	44.1	6.01	G.D.B: *
Meaty	21.2	21.6	21.4	21.0	21.7	22.4	19.5	22.4	20.3	22.5	1.42	Breed: *
Greasy	24.0	23.8	24.2	25.0	23.3	25.1	23.2	22.5	21.8	25.9	1.39	Breed: *
<i>Aroma of Meat</i>												
Fatty	15.0	15.6	13.3	14.4	14.7	16.7	15.6	17.0	14.8	15.8	1.56	Diet: *
Acidic	4.2	4.0	3.9	4.4	3.7	4.3	3.5	4.7	4.1	4.1	2.05	G.D.B *
Farmyard	10.9	11.3	11.1	10.3	10.6	12.4	11.3	10.9	10.8	11.4	1.58	G.B.: *
Cheesy	1.8	1.7	1.4	1.8	1.9	1.5	1.7	2.0	1.7	1.8	1.27	G.D.B: *
<i>Aftertaste</i>												
Intense	23.4	24.1	24.4	24.7	25.2	24.1	22.6	21.5	24.0	23.5	1.64	G.B.: *

a M = entire male (ram); C = castrate; b Conc = concentrate; GSil, CSil = grass or clover silage; c SBx = Swaledale Blackface cross, Sfx = Suffolk cross; d Significance: *, **, *** = P<0.05, 0.01, 0.001; G.B, G.D.B = second and third order interactions of gender x breed and diet x gender x breed.

Table 2. Occurrence of off-flavours and aromas – number of animals where mean score from sensitive assessors exceeded 50

	Gender ^a		Diet ^b						Breed ^c	
	M	C	Grass	Rape	Turnip	Conc	Gsil	CSil	SBx	Sfx
Farmyard aroma of meat	2	6	1	3	1	1	0	2	3	5
Sour aroma of Meat	0	2	0	1	0	1	0	0	1	1
Piggy aroma of Meat	0	3	0	1	0	1	0	1	1	2
Sour flavour of Meat	0	4	0	1	0	1	1	1	2	2

a M = entire male (ram); C = castrate; b Conc = concentrate; GSil, CSil = grass or clover silage; c SBx = Swaledale Blackface cross, Sfx = Suffolk cross

IV. CONCLUSION

There is no indication of any adverse flavour of ram lamb meat. Some animals receive higher scores for descriptors associated with off-flavour from sensitive assessors. These occurrences appear to be associated especially with castrates and rape diets.

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