

# ODOUR-ACTIVE COMPOUNDS OF LAMB COMMERCIALIZED IN NORTHERN SPAIN

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**Abstract** –The odour-active compounds released during cooking (GC/MS/O) were characterized in lamb chops (*Longissimus thoracis et lumborum*, n=48) collected at retail level in northern Spain, where light lamb is typically produced. Overall, the main odour-active compounds of cooked lamb were described as ‘green’, ‘meaty’, ‘roasted’, and ‘fatty’. Aldehydes and alcohols were the most abundant volatile compounds, although methional, dimethyl pyrazine, and dimethyl trisulphide related to desirable meaty aromas, were the most powerful odorants.

**Key Words** – aroma, ovine meat, olfactometry.

## I. INTRODUCTION

Odour-active compounds released from cooked meat are formed by chemical reactions which are affected by *ante-* (*i.e.*, body weight, production system) and *post-mortem* (*i.e.*, cooking) factors. Briefly, hydrocarbons and alcohols are products of lipid oxidation, sulfur-containing compounds are products of sulfur-containing amino acid reactions, and carbonyl and N-heterocyclic compounds are products of Maillard reaction, lipid oxidation, and/or a combination of both [1]. In northern Spain, ovine meat production system is mainly based on the slaughter of suckling (< 7 kg carcass weight) and light lambs (5-13 kg carcass weight). However, most of the literature at international level is focused on heavier sheep carcasses obtained from older animals [2]. Thus, the objective of this study was to characterize the odour-active volatile compounds released during cooking of suckling and light lambs commercialized in northern Spain.

## II. MATERIALS AND METHODS

Lamb chops from Basque and Navarre regions of northern Spain were surveyed from 48 retail stores. *Longissimus thoracis et lumborum* muscle pieces were cooked (80 °C internal temperature), volatiles were extracted by a dynamic headspace (50 mL/min of N<sub>2</sub>, 30 min), collected in Tenax TA trap (SGC Europe Ltd) and placed in the UNITY 1 thermal desorption equipment coupled to an Ultra autosampler connected to a 6890 GC (Agilent Tech.) with two detection ports: 5975b mass spectrometer and an olfactory detection port. A Zebtron-5ms column (30 m, 0.32 mm i.d., 0.50 µm film thickness; Phenomenex Inc.) was used to separate the volatile compounds, helium was used as carrier gas (0.2 MPa constant pressure) and the oven temperature was programmed from 40 °C to 265 °C at 6 °C/min.

## III. RESULTS AND DISCUSSION

The odour analyst detected a total of 43 odour zones (OZs), but the odour profile of cooked lamb was defined by 21 OZs that were positively detected in more than 90 % of the samples (Table 1). In these OZs, aldehydes, alcohols, sulfur-containing and N-heterocyclic compounds were mainly identified. The odour of most frequent aldehydes and alcohols was described as ‘green’ and ‘fruity’, although some of them were described with other specific odour notes such as ‘sharp’, ‘roasted’, ‘mushroom’, ‘rubber’, and ‘fatty’. The most frequent sulfur-containing and N-heterocyclic odorants were described as ‘meaty’, ‘cooked’ and ‘fried potato’, ‘faecal’, and ‘wood’.

According to mass spectra, the most abundant odorant compounds were several aldehydes and alcohols such as hexanal, 1-octen-3-ol, and octanal also reported by others [3]. On the contrary, methional, 2,5-(and 2,6)-dimethyl pyrazine, and dimethyl trisulphide showed low abundance but, at the same time, were perceived by the olfactometry analyst as very intense odours compared to the rest of the OZs. Therefore, they were considered key-odorants of cooked lamb. Together with other sulfur-containing and N-heterocyclic compounds (*i.e.*, 2-methyl-3-furanthiol, 2-

pentyl-furan, benzothiazole), they have been described as derived from Maillard reaction and Strecker degradation, and as primary meat-odour active compounds [2]. Similar to other light lamb studies [3], specific odour compounds associated to ‘mutton’ and ‘pastoral’ odours [4] were not detected in our samples.

Table 1. Odour zones and main odor descriptors obtained by GC/O, experimental linear retention index values ( $LRI_{(Exp)}$ ), and volatile compounds identified by GC/MS cooked lamb samples (n=48).

Odour zone	Odour descriptors	$LRI_{(Exp)}$	Volatile compounds
1	sharp, penetrant	<800	2-methyl-1-propanol <sup>(b)</sup>
2	roasted, fermented	<800	2-methyl butanal <sup>(a)</sup>
3	fresh grass, green grass	803	hexanal <sup>(b)</sup>
4	roasted meat, meat broth	871	2-methyl-3-furanthiol <sup>(a)</sup>
5	green, floral	901	heptanal <sup>(a)</sup>
6	cooked potato	904	methional <sup>(a)</sup>
7	fried potato, bread	909	2,5-(and 2,6)-dimethyl pyrazine <sup>(a)</sup>
8	faecal, rotten food	974	dimethyl trisulphide <sup>(b)</sup>
9	mushroom, damp, soil	980	1-octen-3-ol <sup>(a)</sup>
10	musty, fruity, floral	991	2-octanone <sup>(a)</sup> / 2-pentyl-furan <sup>(a)1</sup>
11	orange peel	1003	octanal <sup>(b)</sup>
12	penetrant, green, rotten flowers	1045	benzeneacetaldehyde <sup>(b)</sup>
13	rubber, burned rubber	1106	( <i>E,E</i> )-2,4-octadienal <sup>(b)</sup>
14	cooked potato	1118	2-acetyl-4-methylthiazole <sup>(b)</sup>
15	sweet, strawberry	1135	unknown
16	wood, floral	1138	2-acetyl-5-methylthiophene <sup>(b)</sup>
17	green, fruity	1148	( <i>E</i> )-2-nonenal <sup>(b)</sup>
18	meaty	1185	1-(2-furfuryl)pyrrole and/or 2-methoxy-3-isobutylpyrazine <sup>(b)1</sup>
19	faecal, rotten meat	1238	benzothiazole <sup>(b)</sup>
20	wood, green	1263	( <i>E</i> )-2-decenal <sup>(b)</sup>
21	fatty, wax, soapy	1308	undecanal <sup>(b)</sup>

<sup>1</sup>Coelution of two aromatic compounds. <sup>(a)</sup>Positive identifications obtained by LRIs and mass spectra comparison with commercial standards;

<sup>(b)</sup>Tentative identifications obtained by comparison of compound mass spectra and NIST mass spectra library, and/or comparison with odour descriptors and LRIs reported in commercial flavour databases.

#### IV. CONCLUSION

The higher abundance of aldehydes and alcohols and the absence of ‘mutton’ and ‘pastoral’ odours supported the marked consumption of light lambs in Basque and Navarre regions (northern Spain). Additionally, odour compounds associated to desirable meaty aromas (*i.e.*, sulfur-containing and N-heterocyclic compounds) were dominant odorants of surveyed lamb samples.

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