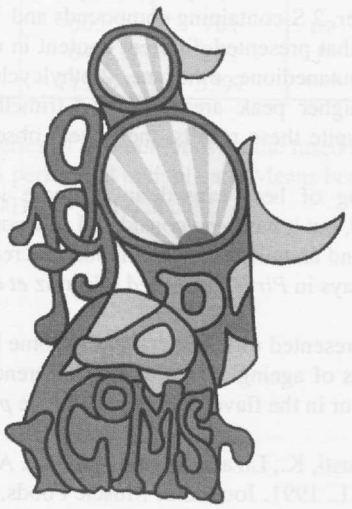
PS 4

Poster session and workshop 4

Meat quality



Tuesday, September 1st
11:15h-12:45h

HEADSPACE VOLATILES OF COOKED BEEF FROM *PIRENAICA* BREED DURING AGEING

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BACKGROUND

Flavor of cooked beef is affected by ageing time, improving its intensity and acceptability (Seidy and Touraille, 1986; Jeremiah *et al.*, 1991). Volatile components contributing to flavor are generated in beef from non-volatile precursors on cooking. Volatile compounds of cooked beef can be analysed in several ways, including steam distillation, solvent extraction, headspace analysis and supercritical fluid extraction (Reineccius and Anandaaman, 1984). The analysis of headspace volatiles determines the compounds in equilibrium with the air above the sample. In a dynamic headspace system these compounds can be trapped/concentrated on an adsorbent material and desorbed into capillary columns to be separated. This method has been used by several authors to study the aroma of beef (Maruri and Larick, 1992; Spanier and Boylston, 1994; Kerler and Grosch, 1996), and it has also been applied in the present work.

OBJETIVES

The aim of the present work was to identify the volatile compounds obtained from the headspace of cooked beef from *Pirenaica* breed and to analyse their evolution during seven days of ageing.

METHODS

Animals: Fifteen heifers (430 kg live weight and 380 days old) and seventeen young bulls (550 kg live weight and 400 days old) from *Pirenaica* breed were slaughtered. After a 48h chill period, *longissimus dorsi* muscle was removed from the left carcass side and three 2 cm thick steaks were individually vacuum-packed and frozen at -24ºC after 2, 4 and 7 days of ageing (4ºC), respectively.

Quantitative headspace volatile analysis: Samples were cooked in a grill at 200ºC until the internal temperature reached 70ºC. Then, the steak was minced and a ten gram sample was weighed into a headspace vial. It was attached to an OI Analytical 4460A purge and trap system, where the sample was purged at 70ºC for 10 min with prepurified helium (40 ml/min). Headspace volatiles were collected on a Tenax trap at 30ºC and thermally desorbed (4 min at 180ºC) onto a DB-5 capillary column (50 m x 320 µm x 1.05 µm). The analysis was performed in a gas chromatograph HP5890 with FID detector. The column inlet pressure was 10 psi, helium was used as the carrier gas with a split ratio of 5:1 with injector and detector temperatures of 150 and 250 ºC, respectively. The oven was temperature programmed from 35ºC (15 min hold) at 8ºC/min to a final temperature of 220ºC and held for 5 min.

Identification of headspace volatiles: Desorbed headspace volatiles were analysed by gas chromatography (HP6890) - mass spectrometry (HP5973) with a ionization potential of 70 eV and a scanning range of 30 to 300 m/z. Column and other relevant GC conditions were the same as described for capillary GC/FID. Peaks were tentatively identified by comparing the mass spectrometry data to that of the reference spectra in the Wiley mass spectral library and the Kovats index with the corresponding literature data.

Statistical analysis was carried out with the SPSS 6.1.2 (1995). The data were analysed using a two-way analysis of variance with treatments being sex (male and female) and ageing time (2, 4 and 7 days). Tukey test was calculated for the main effect means which were significantly different.

RESULTS AND DISCUSSION

Table I lists all the compounds determined in the headspace of cooked beef with their peak areas obtained from GC/FID analysis. Thirty-three volatiles were quantitated with a total of thirty-one being identified. They included 17 hydrocarbons, 4 aldehydes, 3 ketones, 2 aromatic compounds, 1 alcohol, 1 ether, 2 S-containing compounds and 1 miscellaneous compound. Among the identified headspace volatiles, there were some compounds that presented different content in male and female. Meat from young bulls showed higher contents in 2-propanone, tiobismethane, butanedione, n-hexane, 2-ethylcyclobutanone, methylbenzene, 3-methyleneheptane, hexanal and an octene than heifers. Besides, higher peak areas of 2,3,4-trimethylpentane, 2,5-dimethylheptane and 2,2,4,6,6-pentamethylheptane were observed in heifers. Despite these results, there were observed no differences in the flavor profil between sexes of the same breed (Gorraiz *et al.*, 1997).

As it can be observed in table I, ageing of beef caused an decrease in the content of 2-propanone, n-heptane and dimethyldisulfide. Trichloromethane also increased, but it has been considered as a contaminant in the literature. During ageing time 3-methyleneheptane, 2,2,4,6,6-pentamethylheptane and an unidentified compound increased. That evolution could be the responsable for the changes detected in beef aged four and seven days in *Pirenaica* breed (Gorraiz *et al.*, 1997).

CONCLUSIONS

Males and females from *Pirenaica* breed presented different content in some headspace volatiles. A evolution of some volatile compounds was observed from two to seven days of ageing. The study of differences in headspace volatiles of cooked beef during ageing can help to understand the changes that occur in the flavor quality during the *postmostem* ageing period.

LITERATURE CITED

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Table I. Volatile compound content[a] (averaged area counts) in cooked beef at different ageing time (2, 4 and 7 days)

compound	Kovats index[b]	Heifers	Young bulls		2 days	4 days	7 days	
ethanol	-	66283	32716	ns	65385	39016	40950	ns
2-propanone	500	205569	665872	***	500444 [a]	472381 [a]	377490 [b]	*
diethyl ether	508	8728	-		-	1360	10913	ns
tiobismethane	521	28962	56123	***	43464	44654	42055	ns
butanal	557	2791	2460	ns	2639	2613	2594	ns
butanedione	587	14968	21213	***	17760	19872	17225	ns
n-hexane	600	43335	91993	*	66635	66855	74064	ns
trichloromethane	622	11282	12555	ns	20929 [a]	9138 [b]	5808 [b]	***
3-methylbutanal	649	1458	863	ns	1192	1038	1195	ns
benzene	672	976	1145	ns	1175	974	1048	ns
2-methylbutanal	680	322	44	ns	150	303	70	ns
2-ethylcyclobutanone	692	252	1332	***	479	847	1151	ns
n-heptane	700	7044	6176	ns	8133 [a]	6271 [ab]	5344 [b]	*
methylcyclohexane	725	258	163	ns	201	317	106	ns
2-pentene	743	19	-		-	27	-	
dimethyldisulfide	750	458	370	ns	881 [a]	313 [b]	39 [b]	***
2,3,4-trimethylpentane	753	1402	552	*	747	913	1191	ns
2,3,3-trimethylpentane	758	3697	1707	ns	1800	2659	3461	ns
unknown 1	762	111	10	ns	121	-	50	ns
3-methylheptane	773	237	140	ns	161	239	156	ns
methylbenzene	774	2941	4325	*	3494	3533	4002	ns
2,2,5,-trimethylhexane	781	3437	1628	ns	1729	2468	3230	ns
3-methyleneheptane	787	1692	4167	***	1482 [a]	1923 [a]	5616 [b]	***
1-octene	789	2707	1583	ns	1879	2744	1707	ns
n-octane	795	5234	6751	ns	5816	5347	6956	ns
hexanal	796	44964	28932	***	38122	38191	33028	ns
octene	800	3290	4908	*	4557	4162	3729	ns
3-methyl-2-heptene	804	4000	2315	ns	2309	3176	3829	ns
octene	811	2670	1927	ns	2038	2281	2507	ns
2,4-dimethylheptane	819	18	-		25	-	-	
unknown 2	826	605	761	ns	258 [a]	593 [a]	1213 [b]	**
2,5-dimethylheptane	833	647	257	*	288	426	605	ns
2,2,4,6,6-pentamethylheptane	989	11395	5797	***	6551 [a]	8082 [ab]	10630 [b]	***

[a] Kovats indices were detetermined by using a series of hydrocarbons on the fused silica column (DB-5) described under Matherials and Methods. [b] The analysis of each sample was performed in duplicate. Means bearing different superscripts within a row differ significantly (*$p \leq 0.05$, ** $p \leq 0.01$, ***$p \leq 0.001$). [c] -, not detected.