

IDENTIFICATION OF VOLATILES FROM ITALIAN DRIED SALAMI

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SUMMARY

Volatile compounds from five different Italian air-dried salamis were collected by a dynamic headspace sampling method. Most of the identified volatiles were classified as either ketones, aldehydes, alcohols, acids or esters. Many of the compounds were common to four or all five salamis, some, however, seemed to be specific for a particular type. While some of those probably came from added spices, others may have originated from the action of microorganisms present in the salami.

INTRODUCTION

The characteristic taste and aroma of air-dried salami is due to many different components. Some originate from added spices, others are degradation products of carbohydrates, lipids and proteins created during the fermentation, drying and ripening periods. Microorganisms or enzymes and other initiators present in the ingredients may be responsible for those compounds (Lücke, 1985).

It seems most likely that proteolytic breakdown products like free amino acids, peptides, nucleotides, and nucleosides have a pronounced effect on the final taste of salamis, while lipolytic breakdown products like volatile fatty acids, aldehydes, and ketones are of more importance to the aroma.

Several workers have observed an increase in the amount and diversity of carbonyl compounds in different types of fermented sausages during ripening (Cantoni et al, 1967; Langner, 1969; Langner et al, 1970; Stanculescu & Sandulescu, 1970; Demeyer et al, 1974; Fernandez & Rodriguez, 1991). Also several volatile fatty acids have been determined (Cantoni et al, 1967; Langner, 1969; Halvarson, 1973; De Ketelaere, 1974).

An analysis of the total headspace of salami was done by Berger et al (1990). His group isolated volatile components from air-dried salami by dynamic headspace sampling and identified 80 different compounds most of them probably originating from pepper and degraded lipids.

The goal of our study was to qualitatively identify some of the major volatile compounds in air-dried salami and to find out if certain components are always present in a salami.

MATERIALS & METHODS

Imported Italian, air-dried, mould-fermented salamis were obtained from local stores. Headspace volatiles from 50 g of diced salami were purged with nitrogen (grade N50:>99.999%, flow rate 5 mL/min) through a charcoal tube (SKC inc, Pennsylvania, no.226-01, 50/100mg) at 37°C for 24 hr. Sample flasks were conditioned overnight prior to sampling by a nitrogen flow of 5 mL/min

at 150°C. The charcoal tubes were extracted with 1.5 mL of diethylether (high purity grade, Merck no.929) into an injection vial and concentrated to 0.1 mL by gently blowing nitrogen over the ether surface. The concentrates were analyzed by GC/MS. The GC (Hewlett-Packard Model 5890) was equipped with a 30m x 0.32mm id. DB-1701 fused silica capillary coloumn (J&W Sci., Folsom) connected to a flame ionization detector (FID). The oven was programmed from 25 to 250°C. Carrier gas (He) velocity was 30 cm/sec (100°C), injector 250°C, and detector 270°C. The injections were splitless, purge time 0.70 min. For GC/MS a Hewlett-Packard Model 5890 GC interfaced to a TRIO 2000 (VG Biotech, Cheshire) was used. Ionization energy was 70eV, scan time 0.60 sec, transfer line temp. 250°C. Identification was based on GC indices of authentic compounds and of MS spectra compared to the NBS/NIST-database.

RESULTS & DISCUSSION

The results of GC/MS of five different salamis are compiled in table 1. At least 70 or more components, however, were present in the ether extracts as the chromatogram in figur 1 shows. Some of the major peaks originated from different mono- and bicyclic terpenes according to the mass spectras (see fig 1). Their exact configuration could not get reaffirmed by GC, though, and were not included in the table. It is possible that the terpenes originate from added spices. Berger et al (1990) detected many different terpenoid compounds, the distribution of which closely resembled that of pepper essential oil hydrocarbons.

Several of the identified acids, ketones, and aldehydes have been detected by other workers as well (Cantoni et al, 1967; Langner 1969, 1972; Halvarson, 1973; Berger et al, 1990). Especially the straight-chain alkanals and 2-ketones, and acetic, propanoic acid. Only two of the alcohols and none of the esters have, however, been detected by others (Berger et al, 1990). In fact, we have been unable to find any published results showing the presence of esters in salami. It is most likely, though, to find esters in mould-fermented salami as many different molds are known to produce aromatic compounds like alcohols and esters (Kaminski, 1991).

Only a few of the identified volatiles were common to all of the salamis, but several were present in four or five of them. Most of the compounds probably derived from lipids degraded by microorganisms or by autoxidative reactions. Components like octane, pentanal, hexanal, heptanal, 2-heptenal, nonanal, 1-octen-3-ol are typical products of oxidized fat (Frankel, 1983).

The total volatile pattern of each type of salami was quite specific even if some of the components were common to them all. This pattern is no doubt directly related to the characteristic aroma of the particular salami. Future research in our laboratory will delve deeper into the isolation and identification of salami volatiles and into the mechanisms behind aroma development in sausages.

Table 1. Volatile constituents of five Italian salamis

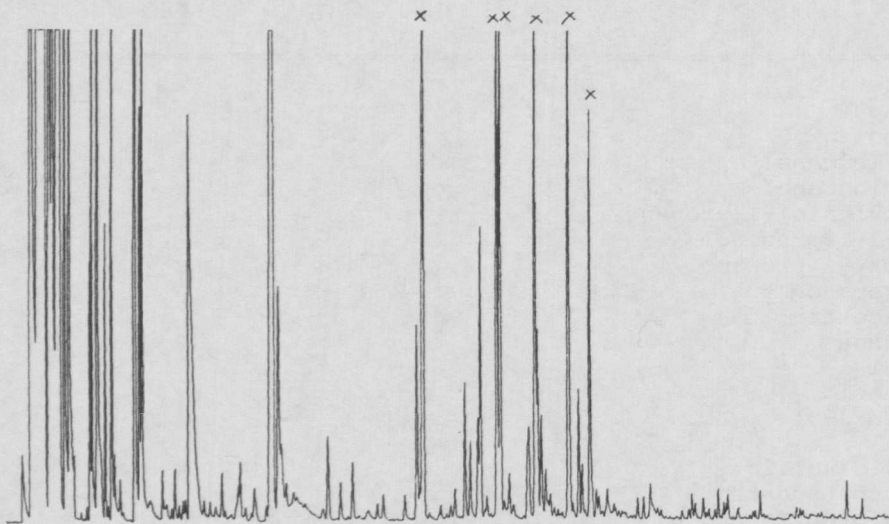
Identification ^a	Compound	A	B	C	D	E
RT/MS	ethylacetate	X	X		X	X
RT/MS	2-butanone	X	X	X	X	X
RT/MS	2-butanol	X	X	X	X	X
MS	3-methylbutanal	X	X	X	X	X
RT/MS	2-methylbutanal	X	X	X	X	X
MS	1-(methylthio)-1-propen	X		X		
RT/MS	2-methyl-1-propanol				X	
MS	1-methoxy-2-propanol				X	X
RT/MS	ethylpropanoate		X			
RT/MS	propylacetate		X			
RT/MS	2-pentanone					X
RT/MS	pentanal	X			X	
RT/MS	acetic acid			X	X	X
RT/MS	1-penten-3-ol	X				
RT/MS	octane	X	X		X	(X)
RT/MS	dimethyldisulfide					X
RT/MS	ethylisobutanoate		(X)		X	
(RT)/MS	1-methylpropylacetate		X	X	X	
RT/MS	3-methyl-2-pentanone	X		X		X
MS	3-hydroxy-2-butanon	X	X	X	X	X
(RT)/MS	3-methyl-1-butanol	X	X		X	X
RT/MS	2-methyl-1-butylformate				(X)	(X)
RT/MS	ethylbutanoate		X	X	X	X
MS	3-hexen-2-one			X		X
RT/MS	hexanal	X	X	X	X	
RT/MS	propanoic acid		X			X
RT/MS	cyclopentanone		X			
RT/MS	ethyl-2-methylbutanoate				X	X
(RT)/MS	ethyl-3-methylbutanoate		X		X	
MS	butandiol		X	X	X	X
(RT)/MS	3-methyl-1-butylacetate		X			X

Table 1., continued

RT/MS	2-methylpropanoic acid					X
RT/MS	4-heptanon	X				
(RT)/MS	4-methyl-1-pentanol		X			
RT/MS	2-heptanone		X			
RT/MS	heptanal				X	
RT/MS	cyclohexanol			X		X
MS	cyclohexanon			X		X
RT/MS	3-methylbutanoic acid					X
RT/MS	2-heptenal	X			X	
RT/MS	ethylhexanoate		X			
RT/MS	1-okten-3-ol	X				
RT/MS	2-nonanone		X			X
RT/MS	hexanoic acid				X	
RT/MS	nonanal		X		X	X
RT/MS	ethyloctanoate				X	

- ^a RT: Retention time compared to authentic compounds.
 MS: Mass spectra compared to NBS-library spectra.
 (RT): Retention data compared to data for isomers.
 (X): NBS-library suggested an isomer.

Figur 1. Gas chromatogram of the headspace of salami E.
x = terpenes.



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