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HEADSPACE VOLATILES OF VARIOUS FERMENTED SAUSAGE PRODUCTS FIGEN KOREL, PAUL L. DAWSON, INYEE Y. HAN and JAMES. C. ACTON Department of Food Science, Clemson University, Clemson, South Carolina, 29634, USA

## KEYWORDS: Volatiles, Fermented Sausage, Flavor Compounds, Headspace Analysis

BACKGROUND: Berdague et al. (1993) attributed volatile compound origins in the manufacture of fermented sausages to lipid oxidation (60%), fermentation (27%), proteolysis (6%) and other sources (7%). Their research and that of Kemner and Nielsen (1994) confirm that starter cultures contribute a characteristic "flavor profile" even though lipid oxidation products predominate due to the effects of aerobic dehydration.

<u>OBJECTIVE</u>: The objective of this study was to evaluate overall volatile flavor compounds among various types of fermented sausages.

METHODS: Thirty-three products representing 8 types of fermented, dry sausages were analyzed for volatile headspace compounds using a Tekmar Model 7000 Headspace Autosampler interfaced to a Hewlett-Packard Model 5890 series II Gas Chromatograph. A <sup>2,0g</sup> sample was sealed in a 9mL headspace vial and heated at 100°C for 20 minutes after which a sample of volatiles was automatically injected onto a 30m fused silica capillary column DB-5 (J&W Scientific) maintained at -20°C. The column was <sup>programmed</sup> from -20°C to 250°C at 10°C/min and then held for an additional 5 min. The FID signals were stored and integrated <sup>using</sup> a Hewlett-Packard Chemstation. Volatiles were tentatively identified on the basis of reference standards. Confirmation of volatile identities was accomplished on a Hewlett-Packard Model 5987 GC-MS. Volatiles were introduced into the GC-MS with a <sup>OSC-1</sup> purge and trap unit (Tekmar). Spectra were identified primarily by comparing with published spectra.

RESULTS AND DISCUSSION: The 8 fermented product categories found in the market area within 175km of Clemson, SC, had <sup>moisture</sup> contents ranging from approximately 62% for Lebanon bologna, a nondried, fermented product, to 26-28% for chorizo and <sup>pepperoni</sup>, which are fully dried, fermented products. Of the total volatiles separated for each product category, approximately 35% <sup>were</sup> identified. Berdague et al. (1993) identified 78 of 86 compounds in their study of flavor compounds produced in dry sausages <sup>not</sup> containing spices or flavoring materials. Seasoning volatiles likely were some of the constituents separated in our commercial <sup>products</sup>.

Of the 58 compounds listed in Table 1, 21 were identified. Twelve compounds appear in every product category while 42 <sup>appear</sup> in at least 5 of 8 product types. For summer sausage, Genoa, Italian, and hard salamis, chorizo and pepperoni, 3 compounds <sup>represented</sup> from 63.8-91.8% of the total area of the volatiles. Acetaldehyde was greater in 3 of the products (30.4-40.7%) and <sup>pentane</sup> was the second in total area for the other 3 products (35.8-63.6%). The third largest component was either diethylether (4.2-<sup>12.0%</sup>) or hexane (8.2%). For Lebanon bologna and pork roll, pentane and acetaldehyde were predominant followed by unknown C (Lebanon bologna) or unknown H (pork roll). While these compounds had greater contributions to the total peak areas within <sup>products</sup>, thresholds for flavor contribution were not considered and in many cases are unknown. Most of the identified compounds <sup>in</sup> Table 1 are likely the result of lipid oxidation. Aldehyde, ketone, alcohol, alkane, sulfur, ether, ester and aromatic compound <sup>classes</sup> are represented in the identified volatiles.

CONCLUSION: From 8 types of fermented sausages, 58 volatiles appeared frequently within one or more product types. Even with diversity involving seasoning, fermentation, heating, and drying variables, many volatiles were present in at least 5 of the 8 product types.

## REFERENCES:

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Table 1. Separated headspace volatiles found in various fermented sausages.

	Retention	Lebanon	Pork	Summer	Genoa	Italian	Hard	1	
Compounds <sup>1</sup>	Time <sup>2</sup>	Bologna	Roll	Sausage	Salami	Salami	Salami	Charina	Domesen
		Grid		Suusuge	Salam	Gataini	Salalill	Chorizo	repperoni
acetaldehyde	3.04	x	v		1.	easing the be	ginning of t	the coverdination	Contraction of
unknown F	3.38	~	~	X	X	X	X	x	x
unknown C	3.40	x		x	X	X	X	X	X
pentane	4.62	x	x	x	X	X	x	X	X
diethyl ether	5.24	x	x	x	x	X	X	X	x
		1949 D. 19, 29		a di ni katela	A Carrier	^	*	X	x
unknown H	5.30	x	x	x	PUTTER PERIOD	x	×	Dendi Dans	an and a state
unknown J	5.58	X		x	x	x	A X	APS St. nois	X
unknown K	6.07	infan orodod		Contractor among "	Silver marked	x	x	x	A
unknown N	6.88	x	х	x	x	X	x	x	The second second
unknown O	7.04	х		x	х	x	DOG2L COLLEGE	x	x
hutanal	7.70			1					*
baxana	7.70	х	X	X	х	x	x	x	x
ethylacetate	1.88	х	х	X	х	x	x	x	x
unknown V	8.83	X		x	х	x	I SPA ADDR	1 512D 10 6413	x
unknown X	0.03	X		X		the Millings	n coefficien	values mis	at he substant
differito with 7k	9.15	X		X	х	x	х	10.00 C 10.00	x
unknown Y	9.33	Y		a second and a				1.	
unknown AA	9.57	x	X	X	x	х	X	x	x
1-heptene	10.16	x	A	X	X	X	x	x	x
pentanal	10.37	x	x	A N	X	distance, birsha	X	aligned and	x
unknown AL	11.21	x	^	X	X	X	x	x	x
	144.03 30 314	No. 2 donte		^	A	X	х	X	X
dimethyl disulfide	11.66	x		x	a ca unacia				ANNOUNCED NO. 1
unknown AP	11.81	1999 C. 202.25		-	Y	X	X	x	X
1-pentanol	12.14	x		x	4		X	Contraction Line	x
unknown AS	12.42			x	NOT HE YON	x	A	Con 225 () Property	X
unknown AT	12.62	x		K hilt on her	innabil utan	x	A Y	aleria and	x
					and the second second	~	~	CURRENT OF	X
hexanal	12.80	x	х	x	x	X and	tentore di a m	a start and a start and a start	we also added
unknown AY	13.60	x		x		~	~	^	X
1-hexanol	14.47	NUCLEON OF STREET, STR		x	and standards	x	v	(Telepost)	ing and been a
2-heptanone	14.67	1938 33979		x	a Batan	~	~		
heptanal	15.00	x	x	x			*		X
Washingto as is	ar Clemana. - 28% for che	Product, to 21	e energiados o posicionario o posicionario		nitgolog no	and a local		organ arout	X
Compounds <sup>1</sup>	Retention	Lebanon	Pork	Summer	Genoa	Italian	Hard	ongia anost	
Compounds <sup>1</sup>	Retention Time <sup>2</sup>	Lebanon Bologna	Pork Roll	Summer Sausage	Genoa Salami	Italian Salami	A Hard Salami	Chorizo	Pepperoni
Compounds <sup>1</sup>	Retention Time <sup>2</sup>	Lebanon Bologna	Pork Roll	Summer Sausage	Genoa Salami	Italian Salami	Hard Salami	Chorizo	Pepperoni
Compounds <sup>1</sup>	Retention Time <sup>2</sup>	Lebanon Bologna x	Pork Roll	Summer Sausage	Genoa Salami x	Italian Salami	Hard Salami	Chorizo	Pepperoni
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<sup>1</sup> Named compounds were identified using comparison of retention time (RT) to that of known standards with verification by mass spectrometry (MS).

<sup>2</sup> Retention time in minutes.

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