Relationship between sensory quality and volatile compounds in elderflower (Sambucus nigra L.) extracts

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RELATIONSHIP BETWEEN SENSORY QUALITY AND VOLATILE COMPOUNDS IN ELDERFLOWER (*Sambucus nigra* L.) EXTRACTS

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Background

Elderberry is cultivated in small scale in Europe with the main purpose of producing producing juice from the fruits or extracts from the flowers. Elderflower extracts have extracts have a very attractive flavour and their odour is often close to the native native odour of the flowers [1,2]. The relationship between the odour of volatile volatile compounds and the sensory characteristics of elderflower extracts has been been studied by GC-O [1,2], but still the contribution of individual volatile compounds to the flavour of elderflower extracts is unknown.

Results

A total of 59 volatile compounds were identified and quantified in elderflower elderflower extracts. Elderflower extracts were evaluated by sensory panels and the and the importance of the isolated volatile compounds to elderflower flavour was was determined by classical factor analysis using the results from the sensory analysis analysis and information on the odour of the isolated compounds. Four principal principal components (PC-1–PC-4) explained 72.6% of the data variation. Twenty-Twenty-eight volatile compounds and sensory quality were included in PC-1–PC-4 1–PC-4 that explained 36.9% (PC-1), 20.0% (PC-2), 8.7% (PC-3) and 7.2% (PC-4) of 4) of the total variation, respectively. Important contributors to the elderflower/floral elderflower/floral flavour of the extracts were rose oxides, hotrienol, linalool, linalool linalool derivatives and α-terpineol (Table 1, Fig. 1). Fruitiness and freshness of the of the extracts were mainly due to aliphatic aldehydes (pentanal, heptanal, octanal, octanal, (*E*,*E*)-2,4-heptadienal, and (*E*)-2-octenal) and alcohols (e.g., 1-hexanol, 1-1-heptanol, (*E*)-3-hexen-1-ol, (*E*)-2-hexen-1-ol and 2- and 3-methyl-1-butanol).

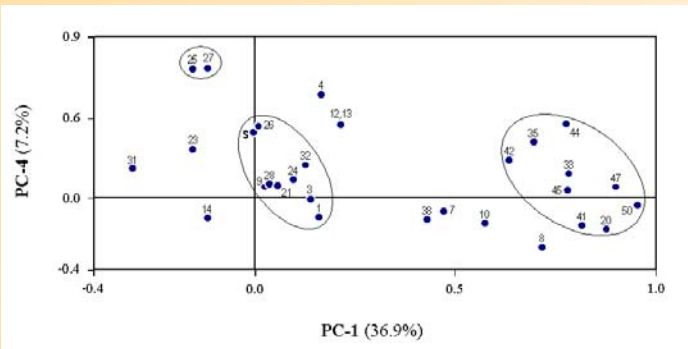

Figure 1. A two-dimensional factor plot of PC-1 and PC-4 showing the association of individual individual volatile compounds (Table 1) to the sensory value (S) of elderflower extracts. Similarly Similarly two-dimensional factor plots were made for the other combinations of PCs. The two-two-dimensional factor plots were used for selection of the most important volatile compounds compounds contributing to the sensory quality of elderflower extracts.

Material & Methods

Plant material. Flowers (approx. 300 g) from 100 different *Sambucus nigra* L. genotypes were collected in Austria, England, and Denmark.

Processing of elderflowers. Elderflower samples (300 g) were extracted with 1200 g sugar solution (420 g water, 30 g citric acid, 750 g sucrose, 150 mg ascorbic acid, 225 mg sodium benzoate) at 4°C for 6 weeks. Elderflower samples were divided into samples of 100 g that were frozen and stored at –24°C until analysis.

Dynamic headspace sampling. Frozen elderflower extracts (100 ml) were thawed (2 h, 25°C) and connected to adsorbent traps (200 mg Porapak Q 50-80 mesh). Samples were purged with N_2 (60 min, 150 ml/min) at 25°C under stirring for headspace sampling. (−)-(*E*)-pinocarveol (int. std., 14.69 µg) was added prior to collection of headspace volatiles. The traps were eluted with CH_2Cl_2 (2 ml).

Analysis of volatile compounds. Volatile compounds were identified by GC-MS on a on a Varian Saturn 2000 ion trap MS (70 eV) interfaced to a Varian Star 3400 CX GC and and quantified by GC on a Hewlett-Packard 5890 Series II Plus GC as described previously previously [2].

Sensory evaluation. Sensory analysis of elderflower extracts were carried out by four four intensively trained sensory panels.

Statistics. Statistical analyses were carried out using Statgraphic Statistical Package. Classical factor analysis was performed according to Sharma [3].

Material and methods are further described in Kaack *et al.* [4].

Table 1. Volatile compounds isolated from samples of elderflower extracts by dynamic headspace technique and contributing to the flavour of elderflower extracts.

No.	Compound	Odour[a]	Average (ng/ml)	SE (ng/ml)[b]	CV (%)	Significance[c]
1	pentanal	fruity, vanilla	38.5	31.2	81.1	***
3	1-penten-3-one	pungent, mustard	14.2	11.6	82.2	***
4	linalool oxide (pyran)	flowery, elderleaves, green	232	211	90.8	***
7	α-phellandrene	flowery, citrus, sweet	34.9	23.1	66.3	***
8	α-terpinene	fruity, lemon	8.1	6.3	88.8	***
9	heptanal	fruity, citrus	40.7	35.4	87	***
10	limonene	fruity, orange, lemon	7.2	4.3	59.9	***
12,13	2- and 3-methyl-1-butanol	fruity, sweet, wine	140	173	124.1	***
14	2-pentylfuran	green bean	0.2	0.2	123.5	***
20	terpinolene	fruity, citrus, pine	1.0	1.1	108.4	***
21	octanal	fruity, citrus	4.6	7.3	158.5	***
23	(*Z*)-3-hexenyl acetate	fruity, green	0.8	0.6	78.6	***
24	6-methyl-5-hepten-2-one	fruity, sweet	15.7	11.1	70.7	***
25	*cis*-rose oxide	flowery, rose, elderflower	307	286	93.2	***
26	1-hexanol	fresh cut grass	99.5	72.9	73.3	***
27	*trans*-rose oxide	flowery, rose	125	112	90	***
28	(*E*)-3-hexen-1-ol	fresh cut grass	7.7	6.3	81.4	***
31	(*E*)-2-hexen-1-ol	gren pepper	16.0	16.2	101.5	***
32	(*E*)-2-octenal	fresh cut grass	1.7	1.0	56.1	***
33	*cis*-linalool oxide (furan)	elderflower, leaves, sweet	232	211	90.8	***
35	1-heptanol	fresh cut grass	11.5	10.5	90.9	***
38	(*E,E*)-2,4-heptadienal	fresh cut grass	2.4	3.1	130.3	***
41	linalool	flowery, fresia, fresh, sweet	470	395	84.1	***
42	1-octanol	sharp, fatty, spicy	8.1	7.1	87.7	***
44	β-caryophyllene	woody, spicy, sweet	2.7	2.3	84.7	***
45	hydroxylinalool	flowery	0.9	0.9	95.8	***
47	hotrienol	elderflower, elderleaves	736	987	134.1	***
50	α-terpineol	faint sweet, flowery	25.4	35.8	139.4	***
	Total average concentration (ng/ml) of volatile compounds		3470			

[a]Odour description obtained from the literature [1,2]. [b]SE = standard error. [c] *$P < 0.05$, **$P < 0.01$, ***$P < 0.001$.

Objective

To identify and quantify volatile compounds in extracts of elderflowers and to to determine the relationship between sensory quality of elderflower extracts and extracts and volatile composition.

Conclusions

- Elderflower extracts showed a large variation with regard to flavour and content of content of volatile compounds.
- A total of 59 volatile compounds were identified in elderflower extracts of which which 28 were found to be closely correlated to elderflower flavour.
- It is possible to select elderflowers with specific sensory characteristics and aroma aroma compound profiles, and hence to produce elderflowers with specific flavour flavour characteristics for the food industry.

References

1. Toulemonde, B. & Richard, H.M.J. (1983). Volatile constituents of dry elder (*Sambucus nigra nigra* L.) flowers. *J. Agric. Food Chem.* **31**, 365–370.
2. Jørgensen, U., Hansen, M., Christensen, L.P., Jensen, K. & Kaack, K. (2000). Olfactory and and quantitative analysis of aroma compounds in elder flower (*Sambucus nigra* L.) drink processed from five cultivars *J. Agric. Food Chem.* **48**, 2376–2383.
3. Sharma, S. (1996). Applied Multivariate Techniques. John Wiley & Sons Inc New York, pp 90–pp 90–143.
4. Kaack, K., Christensen, L.P., Hughes, M. & Eder, R. (2005). Relationship between sensory quality and volatile compounds in elderflower (*Sambucus nigra* L.) extracts. *Eur. Food Food Res. Technol.*, in preparation.

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