

Volatile Compounds in Pork as Affected by Breeds

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Introduction

Most Taiwanese and Japanese think that pork produced in Taiwan is more delicious than that from other countries. Particularly, Taiwanese consumers prefer to eating pork from black-hair bred pig which is a native breed or a crossbred of Taoyuan x Berkshire(TB). So far, no one knows what reason account for such response or perception by the consumers. Thus, we try to do a serial of experiments on the flavour of pork produced in Taiwan to investigate the influence of breed of pigs reared in Taiwan on meat flavour character.

Materials and Methods

Samples of pork loin were taken from Landrace(3), Yorkshire(3), Duroc(3), Crossbred of Landrace x Yorkshire x Duroc, LYD(12), and black hair bred, TB(10) pigs. All the pigs were gilts and raised, slaughtered and chilled under identical conditions. The samples of pork loin were vacuum packed in plastic bags, frozen and then stored at -20°C for analysis.

Aroma concentrates were prepared by using a modified Likens-Nickerson steam distillation-extraction apparatus from 1Kg of ground sample. The flavour components were extracted into n-pentane-ether mixture(1:1 v/v). A Hewlette-Packard Model HP5890 Gas chromatograph equipped with a DB-wax(0.32mm id x 50m, J&W Scientific, USA) capillary column and coupled to a Hewlette-packard Model HP 5972 A MSD mass spectrometer was used.

Results and Discussion

Total ion chromatograms of separated constituents in flavour concentrates of pork analyzed on GC-Mass, are shown in Table 1 and Fig. 1. It was observed that the volatile components isolated from pork loin had 36 components. Of the separated constituents, 18 aldehydes including straight chain saturated aldehydes such as hexanal(peak 1), heptanal(peak 3) octanal(peak 6), nonanal(peak 30) and octadecanal(peak 31); straight chain unsaturated peak aldehydes such as trans-2-heptenal(peak 7), trans-2-octenal(peak 11), trans-2-nonenal(peak 16), trans-2-decenal(peak 22), Trans, trans-2,4-decadienal (peak 24) and cis-9-octadecenal(peak 32), furfural(peak 14), and alpha-isopropylidene furfural(peak 26) with oxygen or nitrogen containing heterocyclic aldehydes, and benzaldehyde(peak 15, a benzen-ring containing aldehyde); 7 alcohols including saturated alcohols such as 1-pentanol(peak 5), hexanol(peak 8), 1-heptanol(peak 13), and 1-octanol(peak 17) and unsaturated alcohols such as penten-3-ol(peak 2), 1-octen-3-ol(peak 12), and trans-2-octen-1-ol(peak 18); 7 carboxylic acids including hexanoic acid(peak 25), octanoic acid(peak 27), decanoic acid(peak 29), dodecanoic acid(peak 34), methyl-11-14-eicosadienoic acid(peak 33), 1,2-benzendicarboxylic acid(peak 35) and tetradecanoic acid(peak 36); 1 alkylfuran-a oxygen containing heterocyclic compound such as 2-pentylfuran(peak 4); 2 terpenes such as 7-methyl-3-octene(peak 10) and naphthalene(peak 21); 1 sulfur-containing heterocyclics such as 2-acetylthiazole(peak 19) were identified.

Results of comparison on the volatile compounds in pork from different breeds of pigs were shown in Table 2 and Fig. 1. It was observed from GC-MS spectra that characteristics of different breeds of pigs were same but composition and proportion were different. As shown in Table 2 and Fig. 1, aldehydes were the major compounds identified in the volatile compounds in pork loin. This is the same result as the data described by Ho et al.(1994). Percentage of individual component in the total volatile compounds from the volatile extracts of pork loin among different breeds of gilts at age of 6.5 months was shown in Table 2. The composition variation was affected by species or breeds significantly. For example, highest level of hexanal(28.14% of total volatile compounds) was found from the pork loin of Yorkshire, while the lowest level(2.37% of total volatile compounds) in the loin from black-hair bred(T x B). The other breeds were ranged from 11 to 16%. However, the highest levels of octanal and nonanal in the loin were found from black-hair breed (TxB), but the lowest level from Hybrid pig(LYD). The ratio of trans-2-decadienal in the total volatile compounds was the lowest in black hair breed(TxB) and hybrid(LYD) pigs. The highest hexadecanal content in the total volatile compounds was from Yorkshire. However, the total aldehydes content was the lowest in the loin found from black-hair breed(TxB) and Yorkshire.

Conclusion, The volatile compounds of pork loin were prepared using a modified Likens-Nickerson steam distillation-extraction with n-pentane:ether mixture(1:1v/v) and analyzed using GC-MS to compare the difference as affected by breed. Totally, 36 components of the volatile compounds were isolated from pork loin of all breeds of pigs used in this study and identified, including 18 aldehydes, 7 alcohols, 7 carboxylic acids, 1 oxygen-containing heterocyclics, 2 terpenes and 1 sulfur-containing heterocyclics. However, the percentage of these compounds was found different among the breeds of pigs. Of these compounds identified, the highest concentration of 1-octen-3-ol and 2-acetylthiazole was found from black-hair breed, which were very important for the formation of meat aroma. These results may be able to be used to explain why the consumers prefer to eating pork from black-hair breed of pigs.

Table 34. Identification of volatile compounds of porcine loin.

Peak No	Compound
1	hexanal
2	1-penten-3-ol
3	heptanal
4	2-pentylfuran
5	1-pentanol
6	octanal
7	trans-2-heptenal
8	hexanol
9	nonanal
10	7-methyl-3-octene
11	trans-2-octenal
12	1-octen-3-ol
13	1-heptanol
14	furfural
15	hexaldehyde
16	trans-2-nonenal
17	1-octanol
18	trans-2-octen-1-ol
19	2-acetylthiazole
20	trans-2-decenal
21	naphthalene
22	trans-2-undecenal
23	trans, cis-2,4-decadienal
24	trans, trans-2,4-decadienal
25	hexanoic acid
26	o-isopropylidene furfural
27	octanoic acid
28	hexadecanal
29	decanoic acid
30	heptadecanal
31	octadecanal
32	cis-9-octadecenal
33	methyl-11,14-eicosadienoic acid
34	dodecanoic acid
35	1,2-benzenedicarboxylic acid
36	tetradecanoic acid

Table 35. Percentage^{aa} of single component or group components in the total volatile compounds from volatile extracts of porcine loin^a among different breed gilts.

Compounds(%)	Breeds			
	Black	Landrace	Yorkshire	Duroc
Aldehydes				
hexanal	2.37	16.18	28.14	13.97
octanal	2.70	1.74	1.85	1.04
nonanal	5.75	3.25	3.93	2.57
trans-2-undecenal	0.31	2.01	0.71	2.91
trans,cis-2,4-decadienal	0.23	1.16	0.75	1.13
trans,trans-2,4-decadienal	1.65	7.56	3.82	9.20
hexadecanal	21.30	15.42	3.09	16.10
total aldehydes	46.18	63.72	54.66	64.39
Alcohols				
Saturated alcohols	9.16	7.14	11.11	5.10
1-penten-3-ol	0.27	0.47	1.79	0.79
1-octen-3-ol	8.19	2.64	4.93	1.68
total unsaturated alcohols	8.46	3.11	6.72	2.47
Acids				
total carboxylic acids	1.93	4.48	0.85	6.13
Heterocyclic compounds				
2-pentylfuran	0.31	2.07	3.10	1.70
2-acetylthiazole	3.84	0.63	1.37	0.61
total heterocyclic compounds	5.18	3.48	5.17	2.90

^a Pigs were fed for 6.5 months.
^{aa} Percentage of single component or group components(%)=(single component or total yields of grouped components / total yields of volatile compounds) × 100

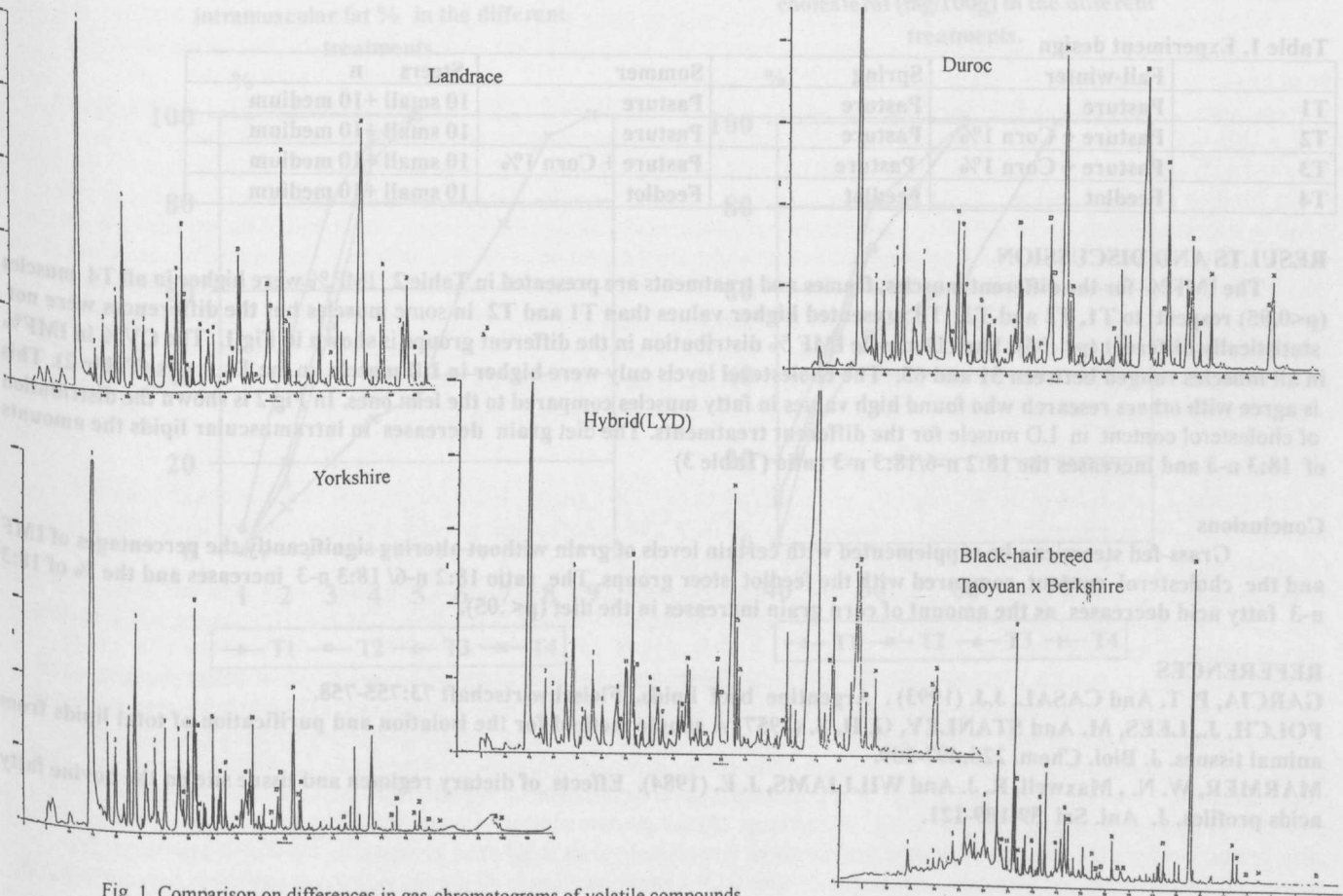


Fig. 1. Comparison on differences in gas-chromatograms of volatile compounds From pork loin among breeds of pigs at age of 6.5 months.