EFFECTS OF INTRAMUSCULAR FAT CONTENT AND BYPRODUCT-BASED DIET ON PORK AROMA COMPOUNDS PROFILE

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I. INTRODUCTION

There is a large interest in increasing the use of byproducts in animal diets. However, it is not clear to what extent this affects meat flavour. Flavour is an important quality attribute determining consumers' meat buying behavior and preferences. Meat flavour consists of a complex mixture of non-volatile and volatile compounds, of which the volatiles are generated through various reactions upon heating. The fat compartment in meat may affect flavour in two ways. Firstly, unsaturated fatty acids undergo oxidation, resulting in carbonyl compounds that significantly affect the aroma. Secondly, fat can act as a depot of fat-soluble compounds that volatilize on thermal processing [1]. Differences in pork flavour are also expected due to differences in pigs' genetics for lipid deposition [2]. In addition, tissue lipids in monogastric animals are influenced by the dietary fat composition. Therefore, the objective of this study was to evaluate the effect of a byproduct-based diet and intramuscular fat (IMF) content on the pork volatile aroma profile.

II. MATERIALS AND METHODS

The pigs used in this study were born at ILVO and were crossbreds from a Piétrain sire line and a hybrid sow line. The feeding trial started in the fattening barn, from 9 weeks of age on and lasted until slaughter. All the pigs were fed a three-phase diet, starting with the same starter diet (9 to 14/15 weeks of age). Half of the pens were then switched to a byproduct-based diet, while the other half remained on the conventional diet. The grower-phase diet lasted from 14/15 until 20 weeks of age, and the finisher diet from 20 weeks of age until slaughter at 24 weeks of age (selected based on an average pen weight higher than 108 kg at 23 weeks), otherwise at 26 weeks of age. The conventional diet was a typical western European pig diet consisting mainly of cereals and soy, while the byproduct-based diet only contained fiber rich byproducts without cereals and soy. For this experiment, we used *longissimus dorsi* muscle (LD) samples from 16 gilts, i.e. 8 LD from animals fed the conventional diet and 8 LD from animals fed the byproduct-based diet. Within each dietary treatment, 4 pork samples were selected with low IMF (1.45% ± 0.10%) and 4 with high IMF (2.40% ± 0.18%). After trimming the external fat, the meat was minced and stored at – 20 °C until further analysis. For volatiles analysis, meat samples (3 g) were heated in a closed vial for 2 hours at 103 °C. Volatiles were then analysed following a SPME-GC-MS method described by Han et al. [3] with some modifications. Odour active values (OAVs) were calculated as the ratio of compounds abundance to their odour thresholds (OTs) [2, 4]. The aroma compounds with OAVs ≥ 1 are considered to contribute to the overall aroma, and are usually called odour active compounds [3, 4]. Data were analysed by two-way ANOVA for the fixed effects of diet and IMF content and their interaction term. The statistical analyses were performed with R 4.2.0. The level of significance was set at $P < 0.05$.

III. RESULTS AND DISCUSSION

A total of 57 aroma compounds were identified and classified according to their chemical nature: 21 aldehydes, 15 hydrocarbons, 7 furans, 6 S-containing compounds, 3 alcohols, 2 ketones, 2 aromatics and 1 N-containing compound.

Table 1 Abundance of aroma compounds with a significant difference among different group (μg·kg^{-1})

Compounds	Formula	Odour	OTs (ppb)	IMF		Diet		SEM	P-value	
				Low	High	Con	Bypro		IMF	Diet
Hexanal	$C_6H_{12}O$	grass, tallow, fat	5	28.09	35.43	38.70	24.81	6.04	0.2520	0.0410
(E)-2-decenal	$C_{10}H_{18}O$	green, fat	0.4	ND	2.79	2.36	0.44	1.12	0.0360	0.1330
Tridecanal	$C_{13}H_{26}O$	flower, sweet, must	10	3.01	1.33	2.64	1.71	0.57	0.0095	0.1156
Tetradecanal	$C_{14}H_{28}O$	roasted, fried	110	4.67	1.95	3.55	3.07	0.66	0.0023	0.5173
Nonadecane	$C_{19}H_40$	alkane	/	3.51	0.72	0.31	3.92	1.38	0.0780	0.0280
P-xylene	C_8H_{10}	unknown	/	0.49	0.58	ND	1.07	0.44	0.8410	0.0260

*Interaction between IMF and diet was not significant, and therefore excluded from the model.
Con: conventional diet, Bypro: byproduct-based diet. ND: no detection.

No significant interaction between IMF and dietary treatment was observed for the abundance of aroma compounds (Table 1). We noted that three aldehydes differed between the low and high IMF group ($P < 0.05$). The abundance of tridecanal and tetradecanal was higher in LD from the low IMF group, whereas (E)-2-decanal was only detected in the high IMF group. Three compounds were affected by the diet ($P < 0.05$). The abundance of hexanal was lower in LD from pigs fed the byproduct-based diet, whereas the abundance of nonadecane was higher on this diet. P-xylene was only detected in LD from pigs fed the byproduct-based diet. The abundance of total hydrocarbons was lower in the byproduct-based dietary treatment, however, due to their high odour thresholds, hydrocarbons have little influence on meat aroma [1]. Among all volatile compounds identified in this study, 20 volatiles were defined as odour active compounds according to their OAV ≥ 1 [3]. Only two odour active compounds differed among treatments (Table 1), (E)-2-decenal which was only detected in pork with high IMF, and hexanal which was lower in LD from pigs fed the byproduct-based diet.

IV. CONCLUSION

In the present study, the abundance of odour active compounds was only slightly affected by a 1% difference in IMF content, and by feeding the pigs a fiber rich byproduct-based diet compared to a conventional diet. Further research is needed to link the chemical analytical findings to sensory evaluation of pork flavour.

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