STUDIES ON FACTORS CONTRIBUTING TO PALATABILITY OF PORK NECK MEAT

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I. INTRODUCTION

Pork is one of popular meats in Japan. Some pork meats such as Tokyo-X are marbled and preferred by Japanese consumer to other breed of pork. The fat contents of these pork meats reached 5-10%. These involve pedigree pigs produced by selective breeding and pigs produced by lysine-imbalance with feeding food waste such as bread [1]. There are some studies on the palatability of those meats. Tokyo-X meat was clarified to be more tender and juicier than LWD (Landrace X Large White X Duroc) meat by physical properties measurement and sensory evaluation [2]. There was no significant difference in intensity of umami taste between Tokyo-X and LWD meats, corresponding to the amount of amino acids and nucleotides. Tokyo-X meat tended to have stronger fatty flavor than LWD meat [3]. Tokyo-X meat has a weaker pork and animal-like odor than LWD, corresponding to lower amount of lipid oxidation products such as aldehydes [3]. Furthermore, neck meat of LWD is more marbled (fat content is ca. 20%) than loin of Tokyo-X meat and is popular cooked meat material in Japan. Although palatability of pork neck meat might be also due to marbling, it has not been clarified. The aim of this study is to reveal factors responsible for the palatability of neck meat.

II. MATERIALS AND METHODS

Pork (LWD) neck meat (M. platysma) (NM) and silverside ham (M. semitendinosus and M. biceps femoris) (SH) are obtained from retail shops. Both meats used in this study were obtained from three to seven different individuals for each experiment. Meats (ca.4 cm X 2 cm X 0.4 cm) were heated in 300 mL of 1% NaCl solution in boiling water bath for 3 min and used for sensory evaluation. Nine trained panelists evaluated umami as taste, sweet and fatty aroma as odor, smoothness and specific chewiness like tongue as texture. Moisture, crude fat and crude protein contents were determined by normal thermal drying, ether extraction and the Kjeldahl method, respectively. Free amino acids and dipeptides were measured by automatic amino acid analyzer of JLC-500/V (JEOL Ltd., Tokyo, Japan). Dynamic-head space SPME (solid phase micro extraction) procedure was performed using a divinylbenzene/ carboxen / polydimethylsiloxane (DVB/CAR/PDMS) fiber to collect aroma components of meats according to the methods of Watanabe et al. [4]. These components were analyzed with Gas chromatography - Mass spectrometry (GC-MS) using GC-MS-QP2010SE (Shimazu Co. Ltd, Kyoto, Japan) equipped with TC-WAX column (0.25mm×60m, GL-Science Co. Ltd, Tokyo, Japan). Meats were saponified and fatty acids were extracted with diethylether-hexane. Obtained fatty acids were converted to methyl esters and analyzed with GC-15A (Shimazu Co. Ltd., Kyoto, Japan) equipped with CP-SIL88 column (0.25 mm x 50 m, Varian Inc., USA).

III. RESULTS AND DISCUSSION

Nine trained panelists compared umami, sweet and fatty aroma, smoothness and specific chewiness between NM and SH. As shown in Table 1, there was no significant difference in umami strength between NM and SH. Sweet and fatty aroma, smoothness and specific chewiness were significantly (P<0.001) stronger in NM than in SH. Thus, palatability of NM seemed to be caused by sweet and fatty aroma, smoothness and specific chewiness.

Content of moisture, crude protein and crude fat of both meats were 60.5±1.89 %, 16.2±0.58 % and 17.6±1.84 % for NM, and 72.4±0.44 %, 22.6±0.28 % and 3 .48±0.40 % for SH, respectively. Significantly (P<0.001) higher amount of crude fat in NM appears to contribute to smoothness of NM. Although specific chewiness could be caused by special structure of muscle fibers and a connective tissue, further investigation was not performed in this study.

Table 1. Paired difference test for boiled neck meat and silverside ham meat of pork

Item	Number of panelists indicating a higher level for		Difference†
	Neck meat	Silverside ham	
Intensity of umami	11	16	NS
Sweet and fatty odor	26	1	***
Smoothness	26	1	***
Characteristic chewiness	26	1	***

† Significant difference is indicated with *** (P<0.001). NS, not different.

Of free amino acids and dipeptides, glutamine content was significantly (P<0.01) higher in NH than in SH, while contents of methionine, leucine, phenylalanine, carnosine and anserine were significantly (P<0.05 or P<0.01) higher in SH than in NM. However, there was no significant differences in the contents of glutamic acid and aspartic acid as well as other amino acids between NM and SH, suggesting to be responsible for no difference in umami strength between both meats.

Headspace analysis of NM and SH with SPME and GC-MS was performed to clarify compounds responsible for sweet and fatty aroma. The analysis detected and measured 6 alkanes, 5 aromatic compounds, 10 aldehydes, 6 ketones, 16 alcohols, 10 acids, 4 esters, 9 lactones and 4 other compounds. Of alcohols, 2-ethyl-1-hexanol was tended to be more abundant in NM than in SH. Of lactones, although butyrolactone, γ-heptalactone and γ-nonalactone were tended to be more abundant in NM than in SH, γ-hexalactone, δ-octalactone, δ-decalactone, γ-undecalactone and γ-dodecalactone were tended to be more abundant in SH than in NM. 2-Ethyl-1-hexanol, butyrolactone, γ-heptalactone and γ-nonalactone might contribute to sweet and fatty aroma of NM. Of aldehydes, most of aldehydes were tended to be higher amount in SH than in NM. This result is similar to the report that less marbled LWD meat contained higher amount of lipid oxidation products such as aldehydes than more marbled Tokyo-X meat [3].

Analysis of fatty acid composition showed that myristic acid, palmitic acid, palmitoleic acid and heptadecenoic acid were significantly (P<0.05-0.001) more abundant in NM than in SH, although arachidonic acid was significantly (P<0.05) more abundant in SH than in NM. There was no significant difference in the amounts of other fatty acids between NM and SH. Lower amount of arachidonic acid, which is polyunsaturated fatty acid more susceptible to oxidation, in NM might be one of the reason why aldehydes were less abundant in NM than in SH.

IV. CONCLUSION

Sweet and fatty aroma, smoothness and specific chewiness would be responsible factors for palatability of NM. 2-Ethyl-1-hexanol, butyrolactone, γ-heptalactone and γ-nonalactone, which were more abundant in NM, might contribute to sweet and fatty aroma of NM. The difference of fatty acid composition cannot explain the higher amount of those compounds in NM, although lower amount of arachidonic acid might produce lower amount of aldehydes in NM. Further studies are needed to clarify the precursors of those volatile compounds and factors affecting smoothness and specific chewiness.

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REFERENCES

1. Irie, M. (2002). Evaluation methods for pork quality. The Japanese journal of swine science 39:221-254.
2. Takasaki, S., Iizuka, K., Suzuki, A. & Ito, Y. (2005). Chemical, physical and mastication properties of pork from the new “Tokyo X” breed. Journal of Cookery Science of Japan 38:404-409.
3. Iizuka, K., Takasaki, S., Suzuki, A., Morita, K. & Aishima, T. (2006). Comparison of three varieties of pork using quantitative descriptive analysis (QDA). Nippon Shokuhin Kagaku Kaishi 53: 23-30
4. Watanabe, A., Ueda, Y., Higuchi, M. & Shiba. N. (2008). Analysis of volatile compounds in beef fat by dynamic-headspace solid-phase microextraction combined with gas chromatography-mass spectrometry. Journal of food science 73: 420-425.