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Umami in Pork after Chilled Transportation (#384)

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Introduction

In an earlier pork study, it was observed that after chilled transport (43 d, −1.7°C), sweeter taste, stronger caramel flavour and a greater number of sensory notes were detected by trained panel and higher taste liking by consumers than in pork for the domestic Canadian market (5 d, 3.1°C) (Ngapo et al, 2012a,b). Nishimura et al (1988) suggested that the gradual breakdown of the myofibrillar protein structure during ageing results in the generation of peptides and amino acids that change flavour. Indeed, dry-cured meat products have higher concentrations of protein breakdown products than their fresh meat counterparts due, in part, to the extended ageing process (Alfaia et al, 2004). Some of these protein breakdown products include L-glutamate, inosine monophosphate (IMP) and guanosine monophosphate (GMP) which are components of umami. Consequently, dry-cured meat products are rich in umami, a basic taste of importance to the Japanese consumer. Chilled meat is not cured, but like dry-cured meat products, undergoes an extended ageing process. The aim of this study was to evaluate umami and its evolution in chilled Canadian pork destined for the Japanese market.

Methods

Meat: Loins from 40 pigs were collected on-line from a commercial abattoir.

Ageing/chilling: At 48 h p.m., loins were cut into 7.5 cm sections. One section was a 0 d control, one was held at 4.0°C (±0.3°C) for 5 d and four were held at a mean core meat temperature of −1.7°C (±0.1°C) for 13, 28, 43 and 58 d ageing. After ageing, loin sections were portioned, vacuum-packaged and stored at -40°C until required.

Chemical analyses: Free amino acids (FAA) were extracted according to Hughes et al (2002) and determined by RP-HPLC using a Waters AccQ Tag kit. Nucleotide extraction and analyses were according to Ryder (1985) using RP-HPLC.

Equivalent umami concentration (EUC): Estimated according to Chiang et al (2007).

*Statistical analyses: A*nalysis of variance (ANOVA) using the MIXED procedure of SAS (2007). Significant differences determined using LSEMANS statement and Bonferroni option.

Results

Free amino acids (FAA): All FAA increased with increasing ageing at chilled temperatures (P 0.001). Generally the concentrations in samples aged 5 d at 4.0°C were greater than at 0 d (control) and were not significantly different from that at 13 d chilled ageing (P>0.05). Total FAA increased with increasing chilled ageing time (P 0.001). Total FAA of the samples aged 5 d at 4.0°C was between the FAA concentrations at 13 and 28 d chilled ageing.

Nucleotides: Concentrations of CMP, UMP, IMP and GMP decreased with increasing ageing time, whereas XMP increased and no pattern of influence of ageing time on AMP was apparent. The total nucleotide concentration decreased with ageing time, largely a consequence of IMP concentration, which was from four to ten-fold the combined concentrations of the other nucleotides.

Umami: The equivalent umami concentration (EUC) was highest in the meat samples stored 5 d at 4.0°C (*P* 0.001; Table 1). Only after 43 d chilled ageing was the EUC not significantly different than that of the sample aged 5 d at 4.0°C (P > 0.05). However, at 58 d chilled ageing, the EUC was again significantly lower than that of the sample aged 5 d at 4.0°C.

Conclusion

While umami was estimated by Komata (1969) as the sum of glutamic and aspartic acids, a more complex equation was derived by Yamaguchi et al (1971) to estimate the equivalent umami concentration (EUC). This equation incorporates the same two amino acids, as well as four nucleotides. Given that most of the nucleotides in the current study decreased with increasing ageing period, the resulting values and trends of the EUC differ from umami estimates based solely on concentrations of glutamic and aspartic acids. In particular, the relatively high concentration of IMP greatly influenced the EUC and illustrates that simple umami estimates based on glutamic and aspartic acids are potentially flawed.

A lack of differences in the EUC between the domestic (5 d at 4.0°C) and export (43 d at -1.7°C) ageing conditions demonstrates that Canadian pork supplied chilled to Japan has the equivalent umami content of the fresh counterpart. Umami is not a taste in itself but impacts on other flavours upon attaining a threshold concentration. At the low levels observed, it is unlikely that the threshold has been achieved. Even if attained, the EUC may not be sufficiently high that it would be perceived in its effect on other flavours and other compounds may be of greater importance in this type of low temperature chilled meat ageing.

References

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Notes

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Table 1. Mean equivalent umami concentration (EUC) of the 40 pork loins with ageing.

		Ageing time (5 d at 4.0°C or 13-58 d at −1.7°C)[A]						P-value
	Overall	0	5	13	28	43	58	
EUC (g MSG/100 g dry weight)	2.02	1.37^{c}	2.42^{a}	1.94^{b}	2.11^{b}	2.18^{ab}	2.10^{b}	**<0.001**
EUC (g MSG/100 g wet weight)	0.540	0.366^{c}	0.649^{a}	0.519^{b}	0.564^{b}	0.582^{ab}	0.561^{b}	**<0.001**
Number of animals	40	40	40	40	40	40	40	

[A] Means in a row without a common superscript are significantly different ($p<0.05$).

Notes