Generation of taste-active amino acids and peptides from hydrothermal extraction of meat and organ meat

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I. INTRODUCTION

Meat protein hydrolysates are important in the food industry due to their versatility as flavour enhancers and functional ingredients. Opportunities include using these agents in food as a healthier replacement of starch and sugar variants. Currently meat extracts are made from manufacturing streams that have low levels of flavour (being derived from myofribrillar and connective proteins). However, specific interactions with carbonyl, lipid and sulphur compounds during processing have excellent potential for the generation of intense reaction flavours. Flavour technology involves the unit operations of extraction, chemical reactions, separation, concentration and stabilisation, with simple extraction and concentration most commonly utilised to capture flavour components. In this study, we evaluated the generation of amino acids and peptides pertaining to taste from controlled hydrothermal extraction of meat and combinations of meat and organ meat (offal).

II. MATERIALS AND METHODS

Sample preparation: Bovine muscle meat (pH 5.8) minced and meat+kidney (5:1 ratio, w/w), minced and hydrothermally processed at 100°C for 3 h at 0.3 MPa (approximately 3 atm). Clear supernatant obtained by centrifugation was lyophilised to powder and used for amino acid analysis and tastant peptide discovery.
Amino acid analysis: The powder was subjected to amino acid analysis using HPLC after HCl vapour hydrolysis at 110 °C for 24 h followed by AccqTag derivatisation [1].
LC-MS/MS: De-fatted powder was analysed using nanoflow LC-MS directly interfaced to an amazon speed ETD ion trap (Bruker) mass spectrometer in CID mode using automated information-dependent acquisition. Subsequent runs with LC-MS/MS were used for peptide identification.
Identification: Fragmented compounds data were imported into PEAKS Studio 8.0 [2] and interrogated without any enzyme specificity against the UniProt *Bos taurus* database.
In silico discovery of putative tastant peptides: Custom VBA macros were used to search for matches of peptides from 67,000 peptide entries compiled from various databases including BIOPEP, PeptideDB, APD2 and EROP.

III. RESULTS AND DISCUSSION

Amino acid analysis: The amounts of almost all the amino acids were higher in the meat+kidney sample than in the meat only sample. These are reflected in the total protein increase of 22% in the meat+kidney sample.
Of particular interest are the increases in the Glu, Asp and Ala by 33%, 40% and 16% respectively in the meat+kidney compared to the meat only sample (Fig. 1). These amino acids have been shown to influence the sour and umami tastes. Sweet tasting amino acids such as Gly, Ala, Thr, Pro and Ser and bitter amino acids such as Phe, Lys, Val Tyr, Ile and Leu were also more abundant in the meat+kidney sample. The higher abundance of these taste-influencing amino acids in the meat+kidney sample can contribute to the overall perception of taste in combination with conditions favourable to further peptide interactions and the formation of amino acid derivatives.

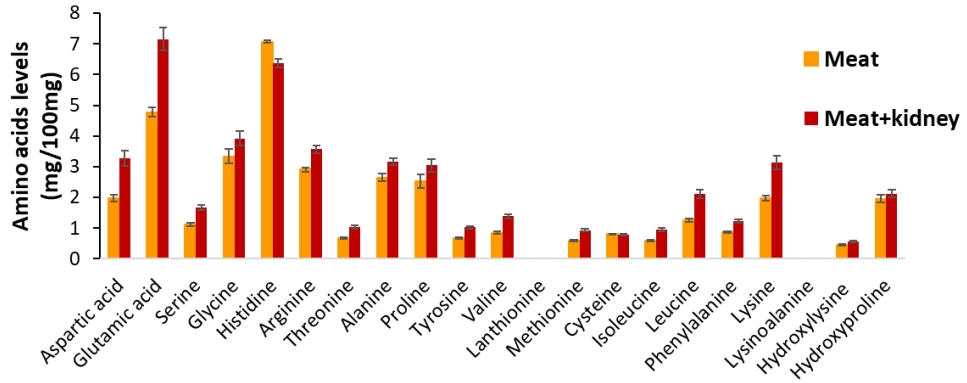

Figure 1. Amino acid profiles of meat and meat+kidney hydrothermally extracted samples. Error bars represent standard error of the means

Tastant analysis: Matches to peptides with sensory properties pertaining to taste (tastants) were also analysed in the meat and meat+kidney samples. Table 1 is representative of the various flavours detected. The differences between the two samples were minimal. The majority of these flavour peptides fall under either the bitter or umami category with a size average of two amino acids (dipeptides). Previous studies indicate that, the interaction of these peptides with free amino acids may influencing taste perceptions in food [3].

Table 1. Tastants (number of peptides) as determined in the meat and meat+kidney hydrolysate samples

Flavour	Meat	Meat+kidney
Bitter	82	87
Salty	9	4
Sour	12	11
Sweet	12	13
Umami	28	22
Total	**143**	**137**

IV. CONCLUSION

Combinations of meat with organ meat followed by hydrothermal extraction, may provide a natural source of enhanced flavouring compounds

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