Potential of Discriminating Different Processed Animal Products Based on Fatty Acid Composition

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1. INTRODUCTION

Considering that the feed bans for processed animal products are expected to change into a 'species to species' ban, methods for species-specific identification will be needed. Fat is one of the major components in processed animal products, whose characteristic is mainly depended on the fatty acids (FA). This study was undertaken to investigate the fatty acid composition of different processed animal products by gas chromatography (GC) and explore its potential for the discrimination of processed animal products at the species level.

2. MATERIAL AND METHODS

2.1 Sample preparation

43 samples, including 7 fish meal (FM), 26 MBM and 10 fat samples were involved in this study. All the MBM and FM samples were milled to less than 1-mm, fat was then extracted using the SoxtecTM 2050 Auto Fat Extraction System (FOSS, Denmark).

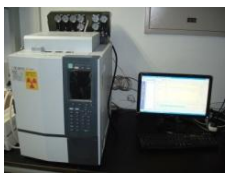
2.2 Chemical analysis

37 fatty acids of all the samples were analysed. The analysis was carried out on a GC (GC-2014C, Shimadzu, Japan), equipped with a flame ionization detector (FID).

2.3 Statistical analysis

One-way ANOVA was used to statistically compare between-group concentration of each FA (SPSS Inc., USA, v. 17.0). Principal component analysis (PCA) and partial least squares-discriminant analysis (PLS-DA) using internal cross-validation were performed as multivariate analysis techniques (The Mathworks Inc., USA, Matlab v. R2010b).

SoxtecTM 2050 (FOSS)



GC-2014C (Shimadzu)

3. RESULTS AND DISCUSSION

3.1 PCA analysis

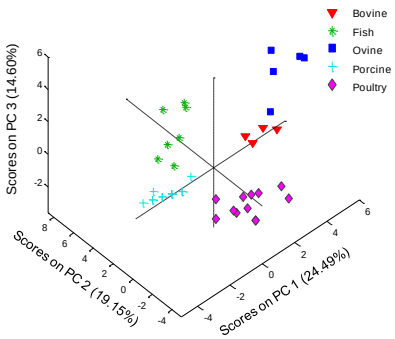


Fig. 1 Based on the presence or absence of all FA

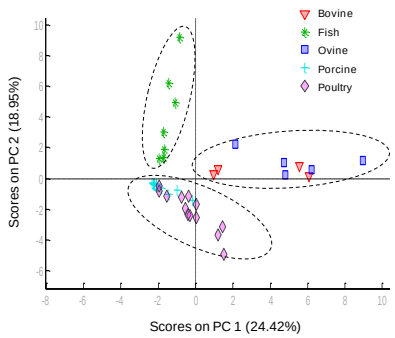


Fig. 2 Based on the concentration of all FA

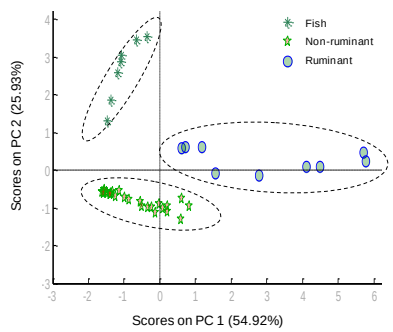


Fig. 3 Based on selected 6 FA (C14:0, C15:0, C17:0, C18:0, C20:2, C22:1n9)

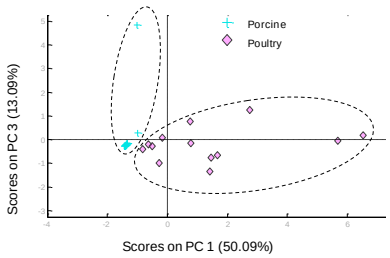


Fig. 4 Based on selected 9 FA (C8:0, C18:1n9t, C18:3n6, C18:3n3, C20:3n3, C20:4n6, C22:6ns, C18:2n6t, C18:1n9c)

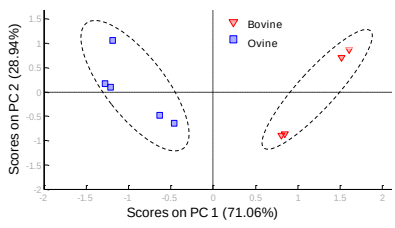


Fig. 5 Based on selected 2 FA (C10:0, C18:3n6)

3.2 PLS-DA results

Table 1 Cross-validation results of PLS-DA

Class	a	b	c	d	e
Sensitivity	1.000	≥ 0.889	1.000	≥ 0.857	1.000
Specificity	≥ 0.950	≥ 0.938	≥ 0.912	≥ 0.857	1.000
Classification error	≤ 0.025	≤ 0.070	≤ 0.044	0.071	0

a - Discrimination of five species samples based on the presence or absence of all FA (Fig. 1);
b - Discrimination of five species samples based on the concentration of all FA (Fig. 2);
c - Discrimination of non- ruminant, ruminant and fish based on selected 6 FA (Fig. 3);
d - Discrimination of porcine and poultry based on selected 9 FA (Fig. 4);
e - Discrimination of bovine and ovine based on selected 2 FA (Fig. 5).

4. CONCLUSIONS

Different fatty acid composition was detected in different kinds of processed animal products. Comparing the discrimination of different species based on concentration of 37 kinds of FA, the discrimination based on presence or absence of FA was proved to be the more effective technique. This allowed to identify five species of processed animal products with good values of sensitivity, specificity and classification error for PLS-DA. A selected choice of FA could be used to distinguish diverse processed animal products effectively.