A sense of authentication: Typicality, origin and organic production

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Introduction

Artisanal dry-cured hams produced from Bentheimer pigs at the farm "De Feijterhof" have their own unique sensory features as a result of organic farming and artisanal dry-curing for at least one year. Since the volatile compounds of hams highly contribute to the sensory properties of hams, their characteristic profiles may be used to determine the typicality of the products, and in conjunction may be useful for authentication purposes.

Aim

The aim of the present study was to develop a method based on Proton Transfer Reaction-Mass Spectrometry (PTR-MS) for the verification of (a) the typicality and (b) the production system (organic vs conventional) of dry-cured hams.

Materials and Methods

Using PTR-MS, 45 ham samples were examined by collecting the headspace data over the mass range m/z 21-150. Averages of quadruplicate measurements were subjected to multivariate data analysis (PCA and PLS-DA; Pirouette 4.01, Infometrix). The 45 samples included 18 commercial conventional samples, and 27 artisanal organic samples. The Feijterhof is a farm which produces artisanal, organic hams and is located at the Dutch/German border. The other hams were obtained/purchased in the Netherlands, Germany and in Spain. The typicality of the Feijterhof hams was evaluated by comparison of the PTR-MS fingerprints of the hams to all others in a classification study.

Results and Discussion

To predict the origin of the Feijterhof hams by their typical fingerprints of volatile compounds, and to predict the production systems of the ham samples, Partial Least Square Discriminant Analysis (PLS-DA) models were estimated and optimised for two separate classifications: (a) Feijterhof vs all others; and (b) organic vs non-organic. The performance of the models was evaluated by cross validation.

Table 1. Predictions of dry-cured ham samples into various classes applying two separate optimised PLS-DA models (A: Feijterhof vs others; B: organic vs conventional). Models were evaluated using a leave-1-out cross validation.

	Predicted / Actual Class	Correct class	Incorrect class	Success rate
A	Feijterhof	18	1	95%
	All others	24	2	92%
B	Organic	26	1	96%
	Conventional	15	3	83%

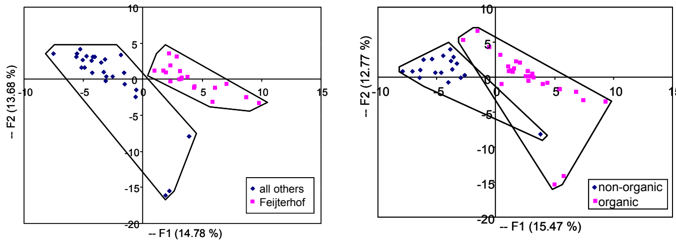

Figure 1. Scores plots of the first two dimensions of PLS-DA (F1 and F2) on PTR-MS headspace data of dry-cured ham samples for two different models using leave-1-out cross validation: (a) Feijterhof vs others (left) and (b) organic vs non-organic (right).

High success rates were obtained for the prediction of samples in their actual class and few samples were misclassified (Table 1). Further evaluation of the PLS-DA scores plots, in the first two dimensions, showed distinct separation of the sample groups when classifying Feijterhof vs all others; and organic vs non-organic (Fig 1). The loadings of the volatile compounds were examined for all PLS-DA classifications and gave a clear view of the volatile compounds associated with the various classes. The positively associated ions are indicated in the typical mass fingerprints of an organic and conventional sample (Fig 2).

Conclusion

The present study showed that typicality (origin) and production system of dry-cured hams characterized by particular volatiles and can, therefore, be successfully verified by PTR-MS fingerprinting.

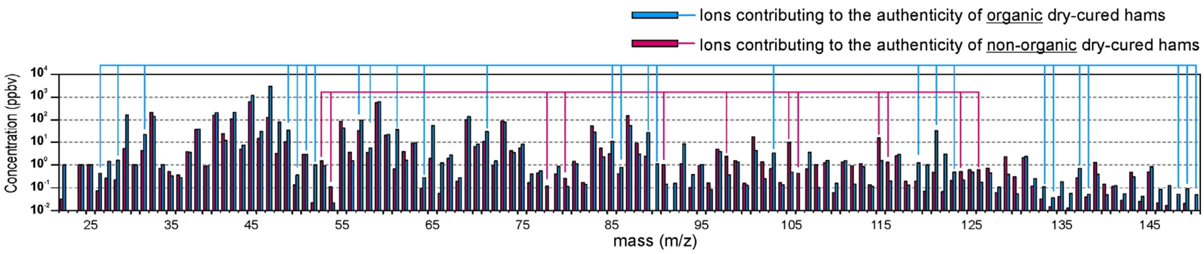

Figure 2. PTR-MS mass fingerprints of the headspace of typical samples of organic and non-organic (conventional) dry-cured ham. Indicated in the mass spectrum are the positively associated ions for each group, determined from the loadings of the PLS-DA analysis. Peaks at m/z 32 and 37 were removed.

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