Verification of the identity of organic feed by fatty acid fingerprinting

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Aim and scope

Identifying high value and/or special food products as organic products is of great interest for producers, consumers and regulatory authorities.

The aim of this study was to develop multivariate statistical models that allow verification of the organic origin of feeds used for laying hens in The Netherlands, based on their fatty acid profiles, in combination with advanced chemometrics.

Samples

Feeds used in the Netherlands for laying hens under 3 different housing systems were collected from farms, from all over the country:

- *12 feeds for the production of organic eggs*
- *14 feeds for the production of regular eggs*
  - *6 free-range*
  - *6 barn (+ 2 used for the production of high omega-3 feeds)*

Analytical methods

The fatty acid composition of feeds (8 g) was determined in triplicate by GC - FID after fat extraction using chloroform/methanol (2:1, v/v), and derivatized into fatty acid methyl esters. Peak areas were normalized to 100 %.

Statistics

Partial Least-Squares Discriminant Analysis (PLS-DA) was conducted on the normalized peak areas to develop classification models to assess the organic origin of feeds. Models were subjected to a leave-10% out cross-validation. Software used was Pirouette 4.0 (Infometrix Inc., USA).

Main Results

Model developing

Several data preprocessing were assayed to find the best PLS-DA classification model to verify the organic origin of feeds (Tab.1).

Tab.1. % Correct classifications obtained by 3 factor PLS-DA models after several data preprocessing.

Data preprocessing	% Correct classifications	
	Organic	Regular
None preprocessing	83%	61.5%
Autoscale	95.8%	84.8%
Mean Center	70.8%	69%
Variance Scale	95.8%	73%
Log10, none preprocessing	67%	100%
Log10, autoscale	95.8%	96.2%
Log10, mean center	67%	92%
Log10, variance scale	95.8%	88.4%

Selected model for organic feeds

From the several developed models (Tab. 1), the most successful classification rates were achieved with the PLS-DA conducted with log10 transformed and autoscaled data (Fig 1).

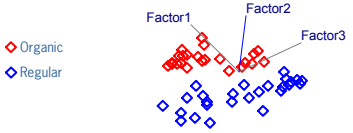

Fig.1. PLS-DA scores plot (log10 transformed and autoscaled data) of feed fatty acid composition.

Regular feeds

PLS-DA model was developed exclusively with fatty acid data corresponding to regular feeds (organic feeds excluded), but no separation was found between these two groups (Fig.2)

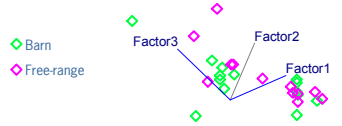

Fig.2. PLS-DA scores plot (log10 transformed and autoscaled data) of regular feed fatty acid composition.

Conclusion

Models built were useful to verify the organic origin of feed used for laying hens in the Netherlands. However, the differentiation between the feeds used for the production of free-range and barn eggs remains quite a challenge.

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