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BOOK OF ABSTRACTS

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Identification of new possible lipid biomarkers for beef meat authenticity as related to the sex of animal

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Aims of the contribution

The aim of present study was to apply analytical methods for characterizing the lipid matter of ground beef meat prepared with both male and female meat, and to use a chemiometric approach for the identification of new possible lipid biomarkers of meat authenticity as related to the sex of animal.

Description of the research

Introduction

Meat is one of the most widely consumed high-value foods in the world, opening it up to fraudulent replacement/substitution of some, or all, of the premium meat content with lower grade cuts of meat or meat from other species. In particular, minced meat is an easy target for food fraud because the original meat cut cannot be visibly recognized by the consumer. One of the most distinctive and quali-quantitative interesting macro components of meat are lipids, since they are linked to dietary health concerns, besides being an important flavor component. In this case, lipidomics, the global study of molecular lipids, could potentially provide an insight into the discovery of lipid biomarkers for identification of food fraud, especially minced meat. In fact, it is necessary to provide additional analytical tools for the authentication of beef meat as further support to the existing ones, in order to defeat meat fraud.

Materials and methods

Forty-two samples (21 males and 21 females) of beef ground meat were randomly selected from 7 different retail stores. Male beef samples were homogenized with female ones at five different ratios, in order to obtain different representative treatments: 100% male (M-100), 75% male – 25% female (M-75), 50% male – 50 % female (M50-F50), 25% male – 75% female (F-25), 100% female (F-100). After sampling, the lipid fraction was extracted and analyzed by gas chromatography coupled to flame ionization detector (GC-FID) and mass spectrometry (GC-MS) for the overall lipid classes profile (Gallina Toschi et al., 2014), total sterols (Inchingolo et al., 2014) and cholesterol oxidation products (COPs) (Cardenia et al., 2012), respectively.

Results

The lipid content did not significantly change as related to the sex of animal, while some significant changes were detected in the main lipid classes. In particular, the level of free fatty acids was significantly higher in male beef meat than in female ones. A lower amount of non-esterified cholesterol was present in samples containing female meat and, as the percentage of female meat increased, the level of non-esterified cholesterol decreased; a similar behaviour was displayed by triacylglycerols. The total sterols were also determined in both lipids and meat, and the results show that, in the lipid matter, the phytosterols (sitosterol and campesterol) were present at significant levels in samples where the female meat was more than 50%. Regarding total cholesterol oxidation products (COPs), they were significantly higher in male meat, while the

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female-containing meat samples displayed the lowest amount. Furthermore, the principal component analysis (PCA) well separated the different five samples, especially according to sterols and COPs.

Conclusions

On the basis of these results, it can be concluded that the chemiometric approach applied to lipidomics could be a useful tool for identifying the origin and authenticity of ground meat as related to the sex of animal. However, this represents a preliminary study and a bigger sampling, as well as a deeper investigation that includes other lipid parameters (such as fatty acids, phospholipids and volatile compounds), is required in order to confirm the actual data reported in the present work.

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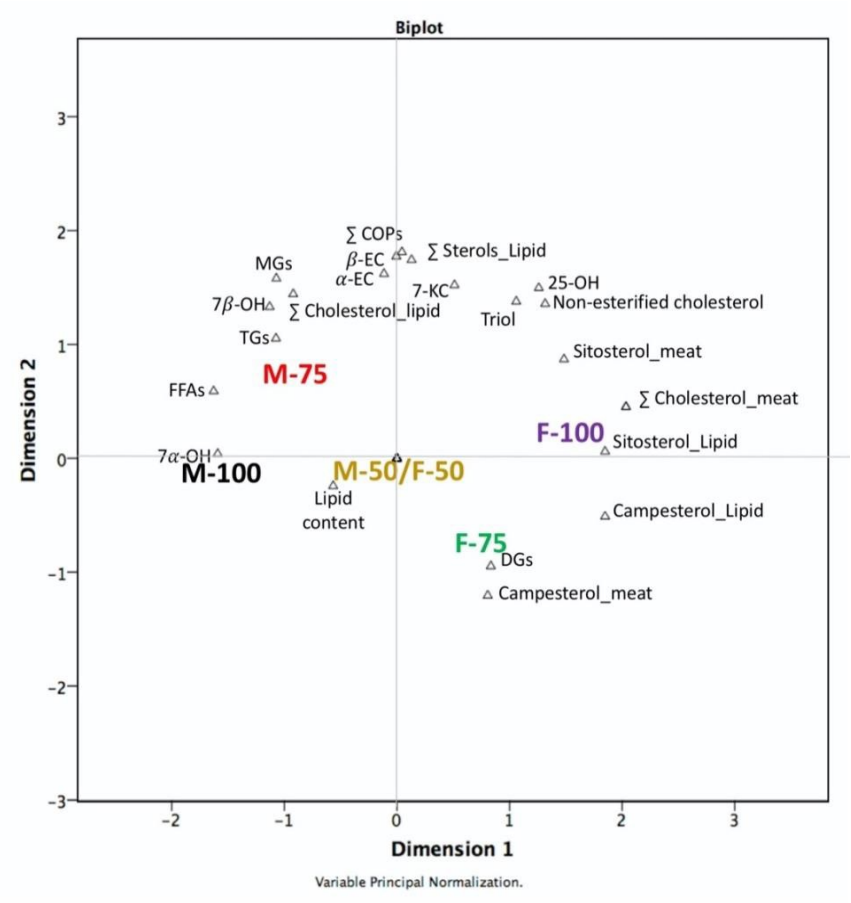
Biplot
Dimension 2
Dimension 1
3
2
1
0
−1
−2
−3
−2
−1
0
1
2
3
∑ COPs
∑ Sterols_Lipid
β-EC
α-EC
MGs
7-KC
25-OH
7β-OH
∑ Cholesterol_lipid
Non-esterified cholesterol
Triol
TGs
Sitosterol_meat
M-75
FFAs
∑ Cholesterol_meat
F-100
Sitosterol_Lipid
7α-OH
M-100
M-50/F-50
Lipid content
Campesterol_Lipid
F-75
DGs
Campesterol_meat
Variable Principal Normalization.