

Classification and Authentication of Meat by Non-targeted HPLC-UV Fingerprinting and Chemometrics

Nil Aijon¹ and Oscar Núñez^{1,2,3}

¹ Department of Chemical Engineering and Analytical Chemistry, University of Barcelona, Spain
² Research Institute in Food Nutrition and Food Safety (INSA-UB), University of Barcelona, Spain
³ Serra Hùnter Programme, Generalitat de Catalunya, Barcelona, Spain
e-mail: oscar.nunez@ub.edu



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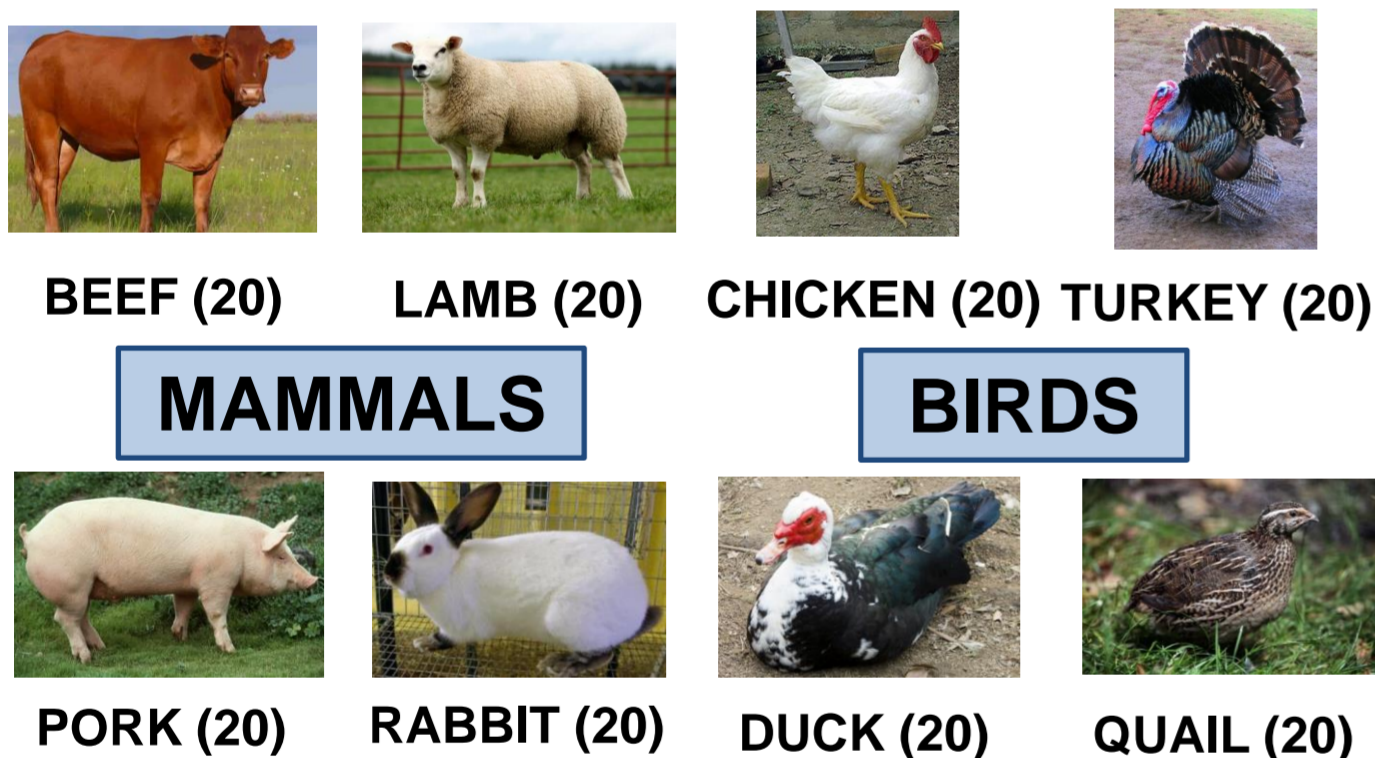
INTRODUCTION & AIM

Meat is a highly consumed product widely susceptible to fraudulent practices. Among the authenticity issues that have begun to be considered by society are meat origin (geographical indication), production practices (organic), and ethical and religious aspects (animal welfare, Halal and Kosher foods, etc.). Although genetic analyses can resolve authentication aspects related to animal species, the factors discussed above cannot be solved genetically. Thus, metabolomics emerges as a strategy that could solve these cases of food fraud since it focuses on analysis of the metabolites present in meat, which will depend on external factors such as stress, diet, production area, etc. In this sense, non-targeted chromatographic fingerprinting approaches are gaining relevance to address food authentication issues. These fingerprinting approaches pursue to register as much chemical instrumental responses from the analyzed samples as possible (chromatographic, spectroscopic, etc.) without the requirement of knowing the identity of the known/unknown metabolites responsible for those responses, thus obtaining feasible and cheaper methodologies not requiring the use of chemical standards for metabolite identification.

The aim of the present contribution is to evaluate the capability of a non-targeted HPLC-UV (at 280 nm) metabolomic fingerprinting methodology in combination with chemometrics for the classification and authentication of meat products of different species, as well as of different quality attributes such as geographical indication or production practices.

METHOD

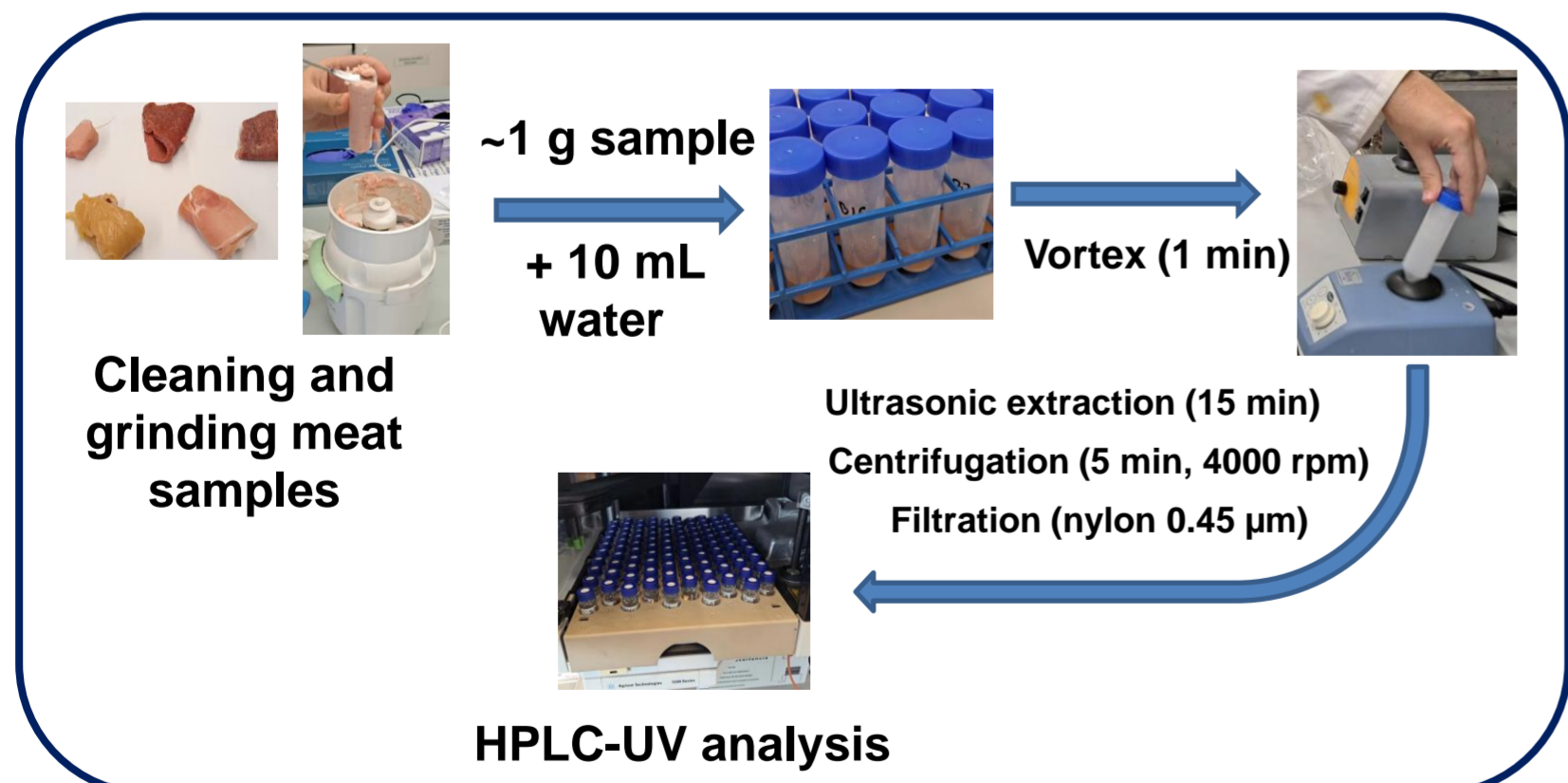
MEAT SAMPLES (SPECIES STUDY)



LAMB SAMPLES FOR GEOGRAPHICAL ORIGIN STUDY



SAMPLE TREATMENT



NON-TARGETED HPLC-UV FINGERPRINTING METHOD



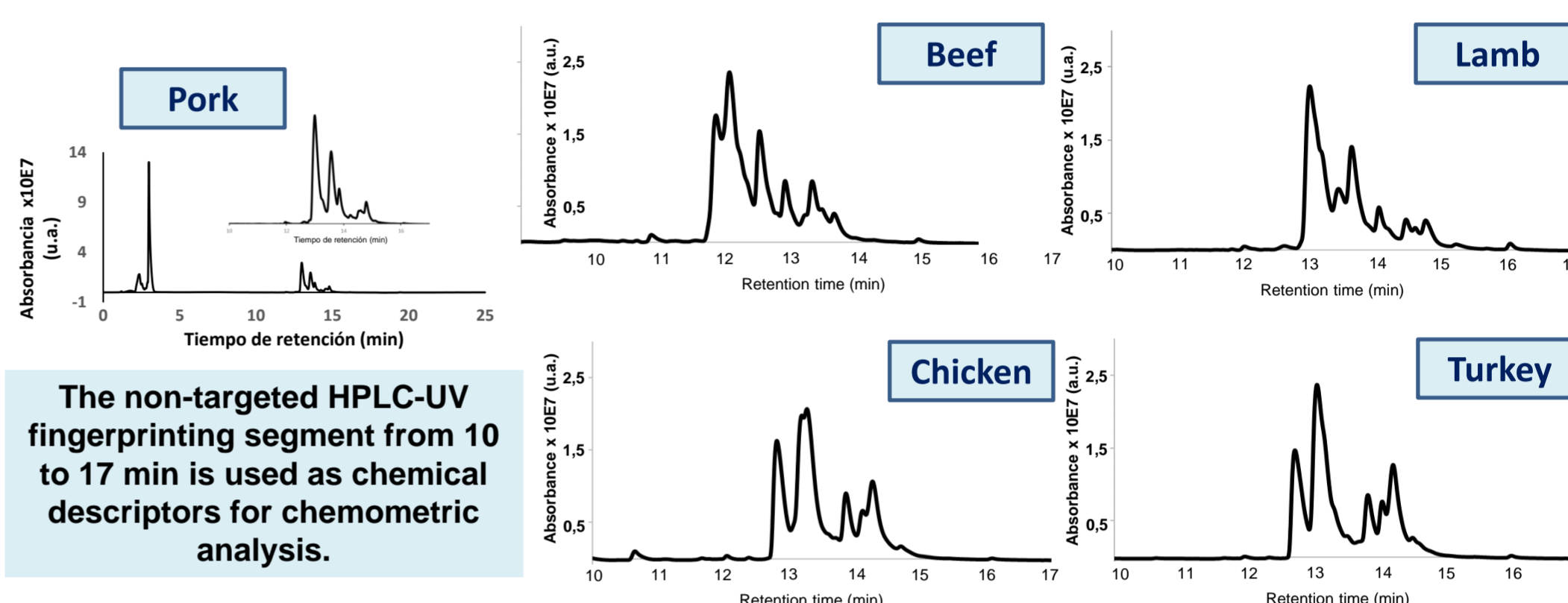
Instrument: Agilent 1100 Series HPLC
Column: Kinetex C18 (10 cm × 4.6 mm, 2.6 µm)
Mobile phase:
A. Water with 0.1% formic acid
B. Acetonitrile
Flow-rate: 400 µL·min⁻¹
Gradient:

Time [min]	Solvent B [%]	Elution mode
0-1	3	Isocratic
1-20	3-95	Lineal
20-22	95	Isocratic
22-22.1	95-3	Lineal
22.1-25	3	Isocratic

UV acquisition: 280 nm
Injection volume: 5 µL

RESULTS & DISCUSSION

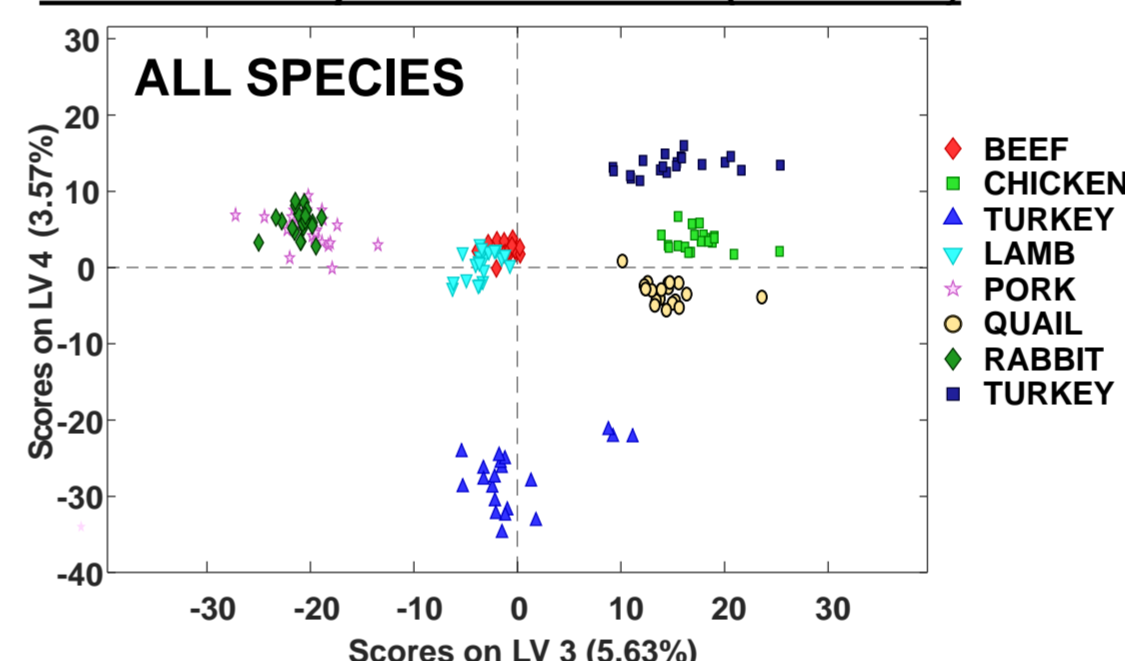
NON-TARGETED HPLC-UV FINGERPRINTS



CLASSIFICATION OF MEAT SAMPLES ACCORDING TO ANIMAL SPECIE

Study using Partial Least Squares-Discriminant Analysis (PLS-DA)

PLS-DA score plot of LV3 vs. LV4 (with 7 LVs)

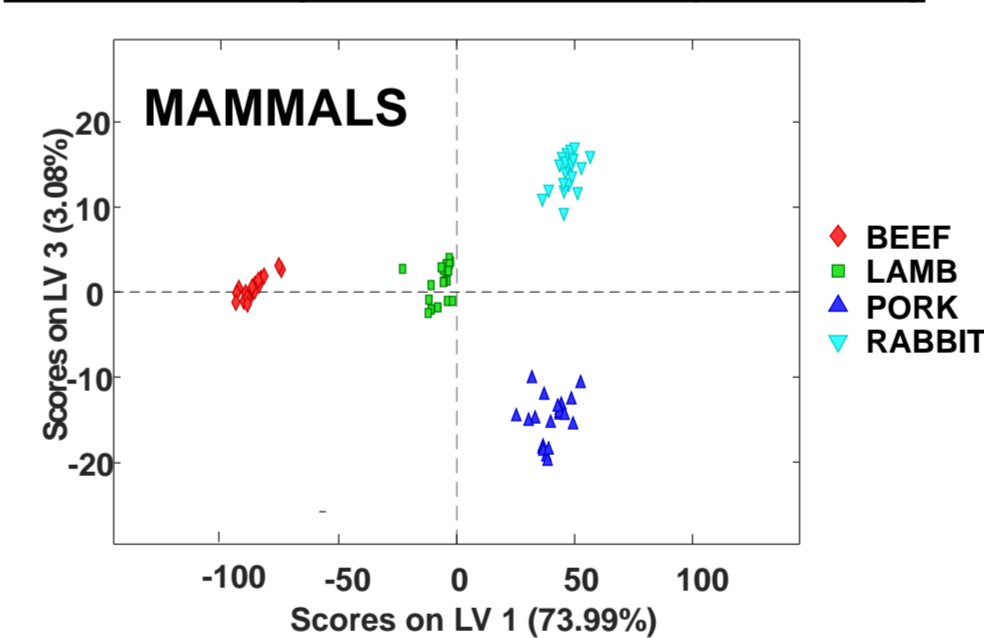


PLS-DA Cross-validation results

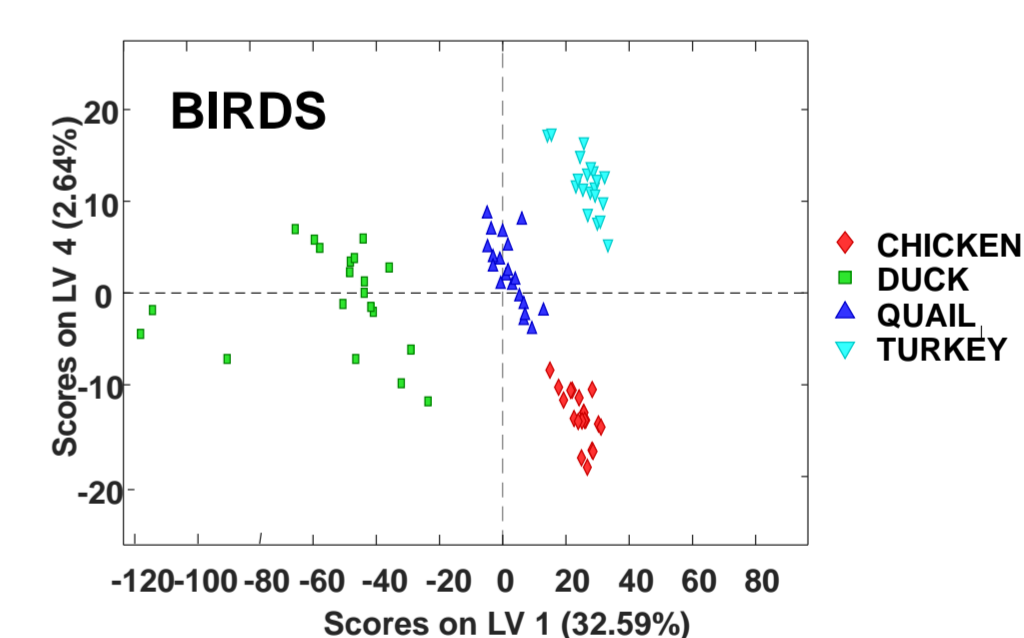
Class	Sensitivity (%)	Specificity (%)	Classification error (%)
Beef	100.0	99.3	0.4
Chicken	95.0	98.6	0.3
Duck	100.0	99.3	0.4
Lamb	100.0	100.0	0
Pork	100.0	99.3	0.4
Quail	100.0	95.7	2
Rabbit	100.0	100.0	0
Turkey	100.0	100.0	0

Sensitivity: capacity to detect true positives
Specificity: capacity to detect true negatives

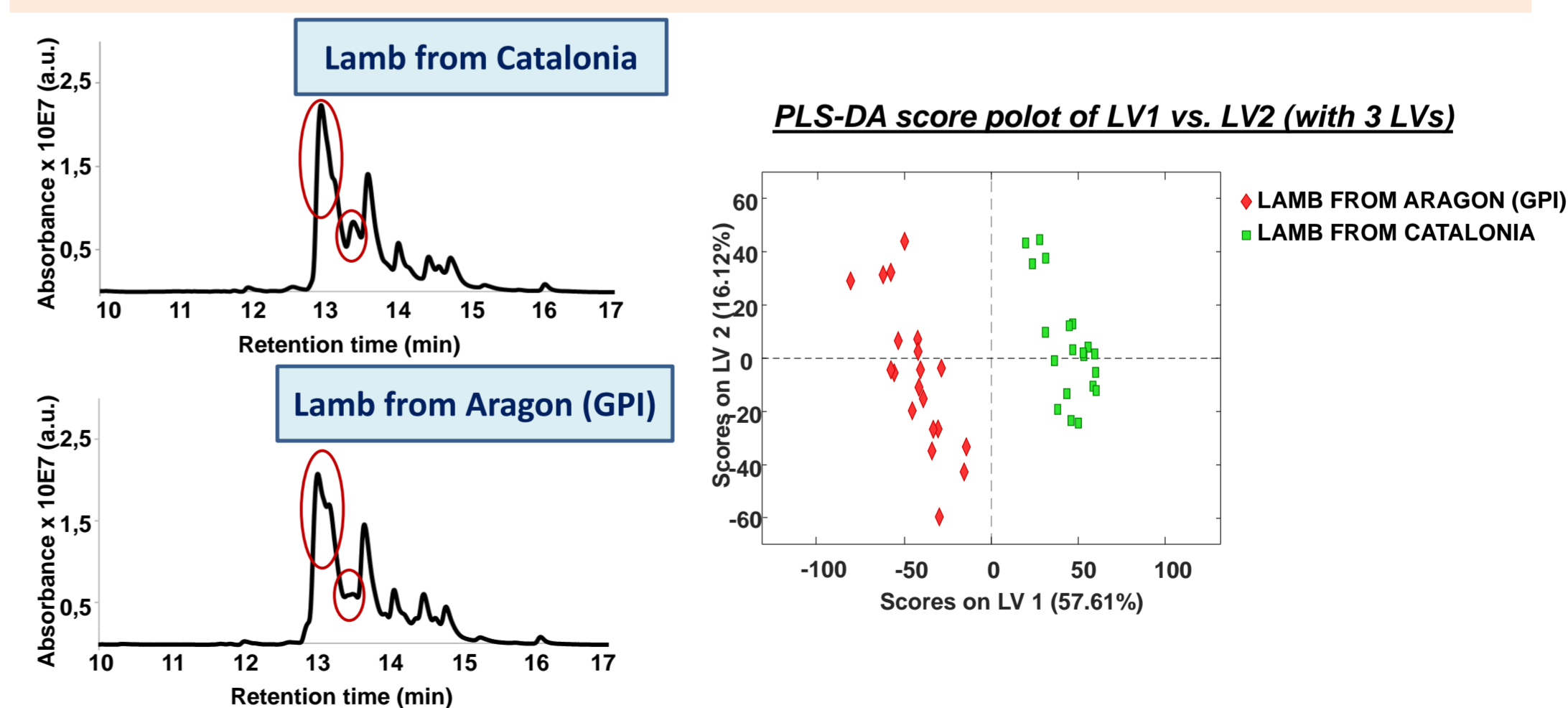
PLS-DA score plot of LV1 vs. LV3 (with 3 LVs)



PLS-DA score plot of LV1 vs. LV4 (with 6 LVs)



CLASSIFICATION OF MEAT SAMPLES ACCORDING TO ANIMAL SPECIE



CONCLUSION

A feasible and simple non-targeted HPLC-UV fingerprinting methodology has been developed, able to correctly classify and authenticate meat samples according to animal specie and geographical production origin.

ACKNOWLEDGEMENTS

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