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Fatty acids profile contribution for the discrimination of olive oil production year

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INTRODUCTION

- ✓ Olive oil is a highly appreciated food product mainly due to its nutritional and healthy properties.
- ✓ Olive oil composition and olive trees productivities are strongly influenced by edaphoclimatic conditions, olive tree density, olive grove age and olive tree variety.
- ✓ In this work, the possibility of assessing olive oil production year based on physicochemical quality attributes, fatty acids and tocopherol profiles, total phenols contents and radical scavenging activities (DPPH and ABTS)
- ✓ cv Arbequina olive oils produced in a high-density olive grove, installed in a non-traditional olive production region in **Valladolid Province (Spain)** during 4 consecutive crop years, were evaluated.

Olive oil analysis

Physicochemical Analysis

Free Acidity (FA)

Peroxide Value (PV)

UV-Vis Extinction Coefficients (K_{232}, K_{270}, ΔK)

Oxidative resistance (Rancimat)

Fatty acids profile (GC-FID)

SFA: C16:0; C17:0; C18:0; C20:0; C22:0; C24:0

MUFA: C16:1; C17:1; C18:1; C20:1

PUFA: C18:2; C18:3

Tocopherol profile (HPLC-FLD)

α-; β- and γ-tocopherol

Total phenol content (Folin–Ciocalteu)

Radical scavenging activities

DPPH

ABTS$^{\bullet+}$

AIMS

OLIVE OILS PHYSICOCHEMICAL COMPOSITION AND PROPERTIES

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Establishment of olive oils' physicochemical putative ***fingerprint***

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Chemometric tools
- Principal component analysis (PCA)
- Linear discriminant analysis (LDA)
- Simulated annealing (SA) variable selection algorithm
- Leave-one-out cross-validation (LOO-CV)

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Predictive performance for assessing cv Arbequna olive oils production year:

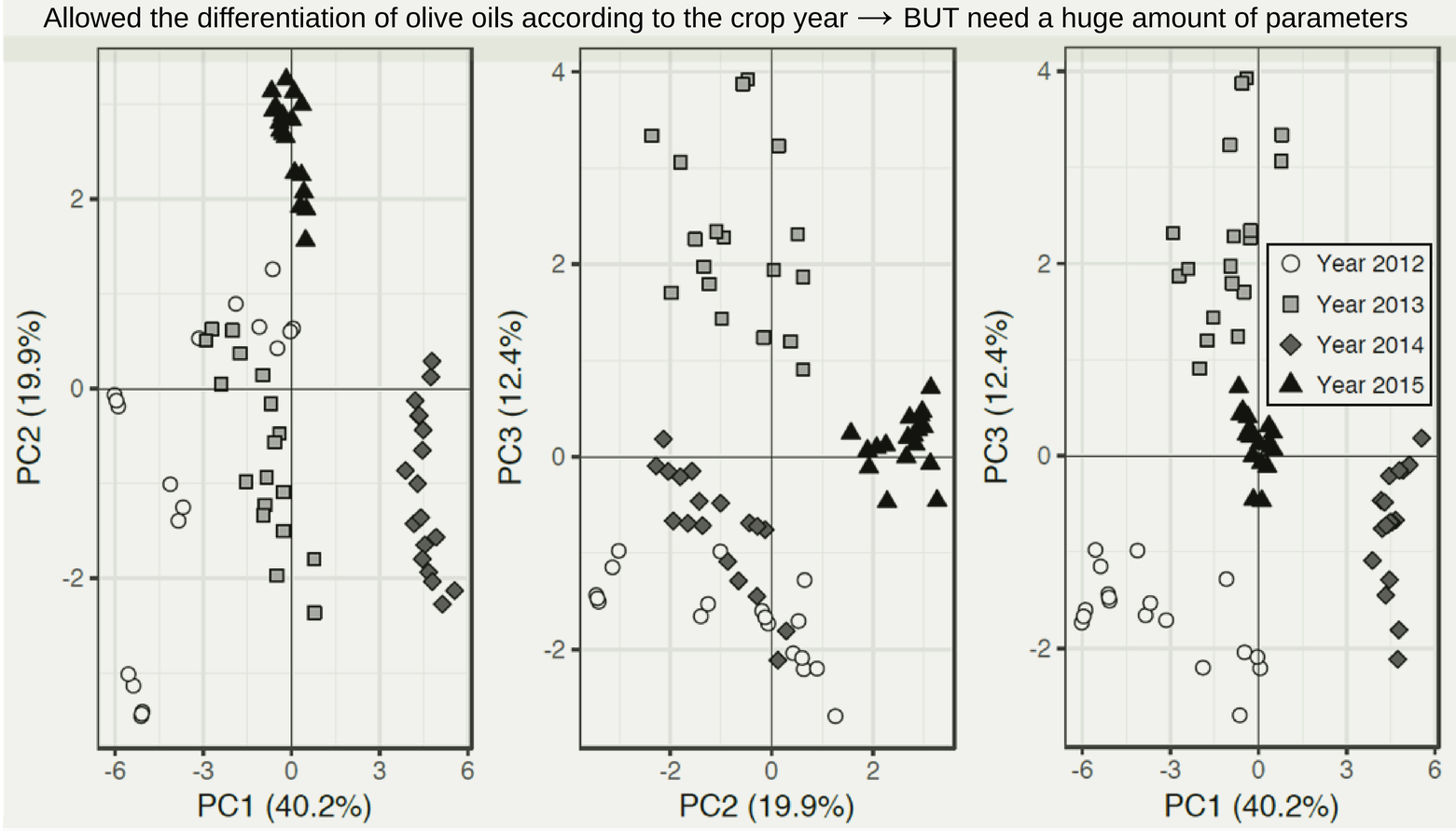
Repeated K-fold-CV (**10 repeats; 4 folds** → 25% of the original data for internal validation purposes)

RESULTS

PCA:

3 first PCs ⟶ explained 72.5% of the data variability

Allowed the differentiation of olive oils according to the crop year ⟶ BUT need a huge amount of parameters



LDA-SA:

→ Selection of sub-set of parameters using the SA algorithm

→ Minimum number of parameters

→ Maximum correct classification, LOO-CV

→ Internal-validation: repeated K-fold-CV

2 first DFs

⟶ explained 99.5% of the data variability

⟶ discriminant model based on only fatty acids

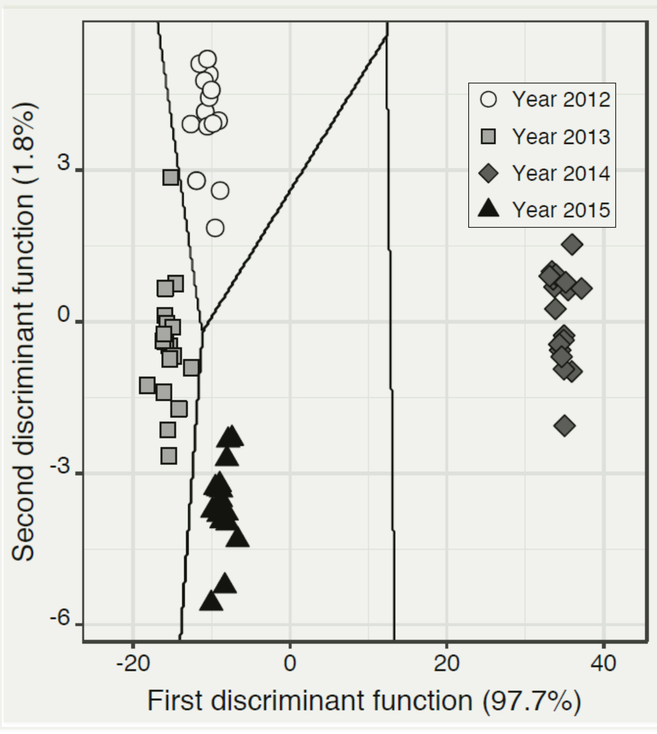
C16:0, C17:0, C20:0
C16:1, C18:1, C20:1
C18:2, C18:3
SFA, PUFA

Correct classifications:

100% original data

100% LOO-CV

99.6±1.4% repeated K-fold-CV



CONCLUSIONS

- All cv Arbequina olive oils evaluated fulfilled the physicochemical thresholds for being classified as EVOO.
- The olive oils' compositions varied with the crop year, allowing to naturally split them according to the crop year (PCA results).
- LDA-SA models based only on fatty acids composition could be successfully applied to discriminate olive oils according to the crop year, pointing out that of fatty acids may be used as putative fingerprints for asssessing olive oil production year.

Acknowledgements

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