# Contribution of δ13C Data as an Authenticity Marker of Croatian Olive Oils

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## INTRODUCTION

Olive oil represents an important ingredient in the Mediterranean diet and is appreciated for both nutritional and sensory properties, often related to geographical area where the olives are grown and the olive cultivar. As consumers demand correct labeling of olive oil, there is a need for analytical techniques that are able to provide data and confirm traceability of origin and authenticity of the oil. Stable isotope ratios have long been known to have enormous potential for food source screening and have been used in authenticity studies for many food products. Results of stable isotope ratios analyzed by EA-IRMS technique are not influenced by cultivar or the agricultural techniques in the groves, and is a valuable tool for geographical discrimination of unknown samples.

## MATERIALS AND METHODS

In this study all major olive production areas in the Adriatic part of Croatia (Istria, Kvarner, and northern, central and southern Dalmatia), and the major soil types on which the olives are grown (anthropogenically modified lithosol, colluvium, and terra rossa) were included. We chose the groves with 'Oblica'; dominant olive cultivar in Croatia, with similar agrotechnical practices in regards to fertilization, irrigation, and pruning; approximately the same fruiting potential and the same fruit load. The olive samples were harvested in all olive growing regions during October and November 2016. The total number of 60 olive fruit samples were collected and processed in oil using laboratory system Abencor mc2 (Ingenieria y sistemas, S.L., Model 672, Sevilla) (Table 1). After processing, oil samples were placed in dark glass bottles and stored in the dark and cold place until analyses. The carbon isotope ratio ($^{13}C/^{12}C$) of bulk oils was determined by EA-IRMS (Elemental Analyzer – Isotope Ratio Mass Spectrometry). All analyses were performed in triplicates. Analysis of variance was performed on the obtained dana using SAS Institute v9.4 software.

## RESULTS AND DISCUSSION

Results of ANOVA analysis showed significant diffences between regions (table 2) from which oil oil samples originated. Lowest ratios were observed in the samples originating from South Dalmatia (-29,99). Second statistically different region was Istria (-29,63), followed by a group of samples originating from North Dalamatia, Kvarnerand Middle Dalmatian Islands. In the region of Middle Dalmatia highest $^{13}C/^{12}C$ were obtained (-28,04). Soil types were also detected as statistically different. All samples originated from four souil types and our analysis showed that Rendzina type had lowest values of C istotope ration while karst antropogenic type of soll had the highest values.

**Table 1. List of samples and their region of origin included in the study**

| ID | Region | Number of samples |
|---|---|---|
| 1 | Istria | 5 |
| 2 | South Dalmatia | 7 |
| 3 | Kvarner | 6 |
| 4 | North Dalmatia | 5 |
| 5 | Middle Dalmatia | 28 |
| 6 | Middle Dalmatian Islands | 9 |
| | TOTAL | 60 |

**Table 2. Results of ANOVA analysis and Duncan multiple range test between regions**

| Region | Average $^{13}C/^{12}C$ value | Duncan multiple range test grouping |
|---|---|---|
| 2 | -29.99 | a |
| 1 | -29.63 | b |
| 4 | -28.97 | c |
| 6 | -28.96 | c |
| 3 | -28.91 | c |
| 5 | -28.04 | d |

**Table 3. Results of ANOVA analysis and Duncan multiple range test of soil types**

| ID | Soil type | Average $^{13}C/^{12}C$ value | Duncan multiple range test grouping |
|---|---|---|---|
| 1 | red soil | -28.86 | b |
| 2 | karst antropogenic | -28.49 | c |
| 3 | rendzina | -29.27 | a |
| 4 | hydromeliorated | -29.02 | ab |

## CONCLUSION

Statistically significant differences were found between different regions in $^{13}C/^{12}C$ values.Lowest values were detected in the samples of olive oil originating from South Dalmatia.Middle Dalmatia had highest values.Rendzina type soil had lowest $^{13}C/^{12}C$ values while karst antropogenic type of soil had highest values. This research will be continued in next year to obtain more dana and to be able to compare all results and to try to distinguish main differences beetwen oli samples from different regions.

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