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# Mediterranean and medicinal plants as source of bioactive essential oils for new natural functional ingredients

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## INTRODUCTION

**Essential oils (EOs):** a feasible solution for the enhancement of food safety and quality due to their antimicrobial and antioxidant activities (Gurtler and Garner, 2022)

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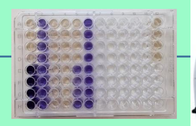
- ✓ to meet the consumer demand for natural and healthy products
- ✓ to reduce the environmental impacts of agro-food sector.

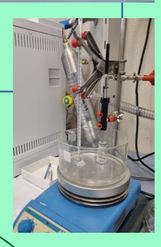
## AIM OF THE RESEARCH

- ✓ **Characterization** of ten EOs obtained from Mediterranean and medicinal plants;
- ✓ Evaluation of EOs **bioactive potential** against food-borne pathogens and spoilage microorganisms;
- ✓ Study of the **influence of intrinsic factor** (pH) on antimicrobial activities.

## METHODS

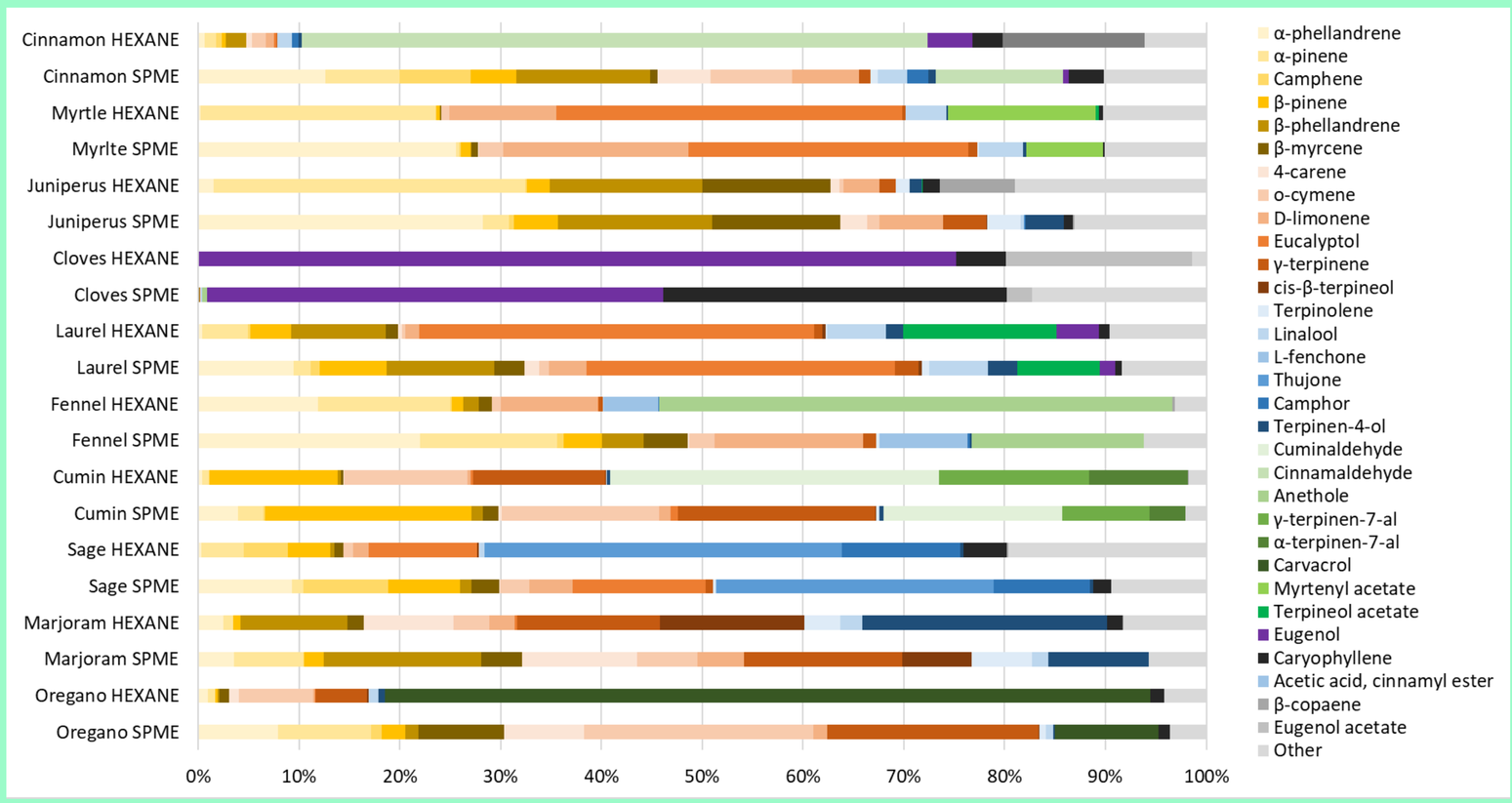
**Characterization of EOs:** comparison between two chromatographic techniques → SPME-GC-MS and direct injection in GC-MS of samples (Barbieri et al., 2022);
**Antimicrobial function:** minimum inhibiting concentration (MIC) assessment against spoilage and food-borne pathogens (Barbieri et al., 2022);
**Antioxidant potential:** in vitro tests using different methods (FRAP, DPPH, and ORAC) (Čagalj et al., 2022).





## RESULTS

**Characterization of EOs composition**




- ✓ **Comparison between direct injection in GC-MS or SPME-GC-MS**

→ interesting VOCs profile, with the presence of molecules that can exert antimicrobial function

→ example of compounds characterized by different percentages depending on the method used (GC-MS *vs* SPME-GC-MS):

- Carvacrol 75.9% *vs* 10.3% (Oregano)
- Eugenol 75.2% *vs* 45.2% (Cloves)
- Cinnamaldehyde 62.0% *vs* 13.7% (Cinnamon)
- Anethole 50.8% *vs* 17.1% (Fennel)

⇩

These differences can be attributed to the limitations of the SPME technique

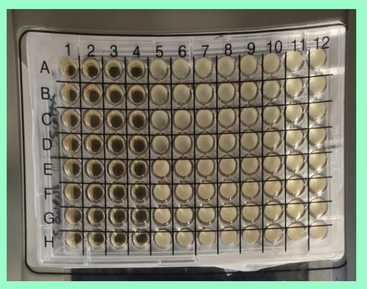
**Many of these compounds are characterized by antimicrobial activity**

**MIC against spoilage and food-borne pathogens**

| Target microorganisms | pH | Cinnamon | Myrlte | Juniperus | Cloves | Laurel | Fennel | Cumin | Sage | Marjoram | Oregano |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Listeria monocytogenes* Scott A** | 7 | **250** | > 5000 | > 5000 | 1000 | > 5000 | > 5000 | > 5000 | > 5000 | 5000 | **250** |
| | 6 | **250** | > 5000 | > 5000 | 1000 | > 5000 | > 5000 | 4000 | > 5000 | 4000 | **200** |
| | 5 | **125** | > 5000 | > 5000 | 250 | 4000 | > 5000 | 2000 | > 5000 | 3000 | **200** |
| ***Staphylococcus aureus* DSM 20231[t]** | 7 | **250** | > 5000 | > 5000 | 1000 | > 5000 | > 5000 | 3000 | 1000 | > 5000 | **250** |
| | 6 | **250** | > 5000 | > 5000 | 1000 | > 5000 | > 5000 | 3000 | 1000 | > 5000 | **200** |
| | 5 | **250** | > 5000 | > 5000 | 250 | 2000 | > 5000 | 1000 | 1000 | 1000 | **150** |
| ***Escherichia coli* 555** | 7 | **250** | > 5000 | > 5000 | 1000 | > 5000 | > 5000 | > 5000 | > 5000 | 3000 | **400** |
| | 6 | **250** | > 5000 | > 5000 | 1000 | > 5000 | > 5000 | > 5000 | > 5000 | 3000 | **300** |
| | 5 | **250** | > 5000 | > 5000 | 1000 | > 5000 | > 5000 | > 5000 | > 5000 | 3000 | **250** |
| ***Enterococcus faecalis* EF37** | 7 | **500** | > 5000 | > 5000 | 3000 | > 5000 | > 5000 | > 5000 | > 5000 | > 5000 | **400** |
| | 6 | **500** | > 5000 | > 5000 | 2000 | > 5000 | > 5000 | > 5000 | > 5000 | > 5000 | **400** |
| | 5 | **500** | > 5000 | > 5000 | 1000 | > 5000 | > 5000 | > 5000 | > 5000 | > 5000 | **300** |

Promising results with **OREGANO and CINNAMON EO** against all the microorganisms tested, in particular *List. monocytogenes* Scott A and *Staphylococcus aureus* DSM 20231[t]:

⇨ probably due to their chemical composition



| EOs | FRAP (mM Te) | DPPH (mM TE/L) | ORAC (mM TE/L) |
|---|---|---|---|
| **Cinnamon** | 0.41 ± 0.02 | 3.16 ± 0.77 | 4.95 ± 0.17 |
| **Myrtle** | - | - | 4.11 ± 0.57 |
| **Juniperus** | 0.01 ± 0.01 | - | 4.09 ± 0.41 |
| **Cloves** | 5.67 ± 0.15 | 34.71 ± 0.90 | 8.88 ± 0.10 |
| **Laurel** | 0.34 ± 0.06 | 1.56 ± 0.41 | 5.79 ± 0.90 |
| **Fennel** | 0.01 ± 0.01 | 1.31 ± 0.41 | 4.55 ± 0.42 |
| **Cumin** | 0.01 ± 0.01 | - | 4.95 ± 0.47 |
| **Sage** | 0.01 ± 0.01 | - | 3.48 ± 0.51 |
| **Marjoram** | - | - | 5.19 ± 0.54 |
| **Oregano** | 0.18 ± 0.01 | - | 5.26 ± 0.29 |

**Antioxidant activity**

*In vitro* antioxidant potential assessed using different methods (FRAP, DPPH, and ORAC) highlighting promising potential for **CLOVES and CINNAMON EO**

## CONCLUSIONS

- ✓ The results highlighted a promising antimicrobial and antioxidant potential OREGANO, CINNAMON and CLOVES EOs.
- ✓ This research can contribute to increase the knowledge of these plant matrices that can be exploited as a source of natural and functional ingredients, characterized by bioactive compounds.

**REFERENCES:** Barbieri et al. (2022). *Scientific reports*, doi: 10.1038/s41598-022-17408-4; Čagalj et al., (2022). *Foods*, doi:10.3390/foods11233847; Gurtler and Garner (2022). *Journal of Food Protection*, doi: 10.4315/JFP-22-017.

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