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Essential oils from mediterranean and medicinal plants: investigation of chemical composition and effects on viability of food-borne pathogens

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INTRODUCTION

Essential oils (EOs): promising mixture of antimicrobial and antioxidant compounds to prevent or reduce the growth of food-borne pathogens (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, extending shelf-life of products

AIM OF THE RESEARCH

✓ **Characterization** of ten EOs obtained from Mediterranean and medicinal plants

✓ Evaluation of EOs **antimicrobial potential** and the **influence of pH** against food-borne pathogens and spoilage microorganisms

✓ Study of the **effects on the viability** of *Listeria monocytogenes* Scott A in the presence of the most promising EOs

METHODS (Barbieri et al., 2022)

Study of EOs chemical composition through chromatographic technique → direct injection in GC-MS of samples

Antimicrobial function: minimum inhibiting concentration (MIC) assessment against spoilage and food-borne pathogens

Flow cytometry: study of *L. monocytogenes* Scott A by flow cytometer to discriminate different physiological cell states (live/injured/dead) in the presence of varying EO concentration (½ MIC, MIC and MBC)

RESULTS

✓Characterization of EO composition:

Complex and interesting profile, with the presence of molecules characterized by a high percentage that describe a specific EO:

- Carvacrol 75.9% (Oregano)
- Eugenol 75.2% (Cloves)
- Cinnamaldehyde 62.0% (Cinnamon)
- Anethole 50.8% (Fennel)

⇨ **These compounds are characterized by antimicrobial activity**

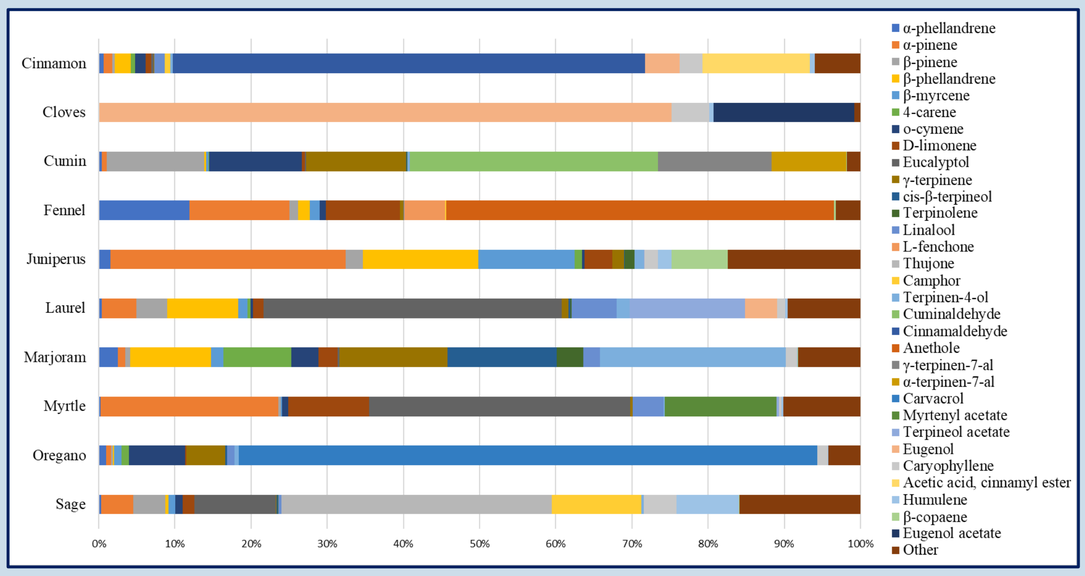

Fig 1. EO chemical composition after direct injection in GC-MS with hexane

Table 1. MIC determination to describe the antimicrobial activity of tested EOs against spoilage and food-borne pathogens

Tested EOs (ppm)	Medium (MH) pH	*Listeria monocytogenes* Scott A	*Staphylococcus aureus* DSM 20231[t]	*Escherichia coli* 555	*Enterococcus faecalis* EF37	*Salmonella enterica* 155
Cinnamon	7	250	250	250	500	500
	6	250	250	250	500	500
	5	125	250	250	500	500
Cloves	7	1000	1000	1000	3000	500
	6	1000	1000	1000	2000	500
	5	250	250	1000	1000	500
Oregano	7	250	250	400	400	250
	6	200	200	300	400	250
	5	200	150	250	300	200

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

✓ **Oregano:** severe effect of EO already after 30 min → viable cells reach value of 10% and < 1% at 125 ppm and other conditions, respectively. These trends were steady up to 120 min

✓ **Cinnamon:** after 30 min of exposure → about 40% of dead cells in each tested condition. In the presence of 500 ppm this data reach value of 80% after 120 min

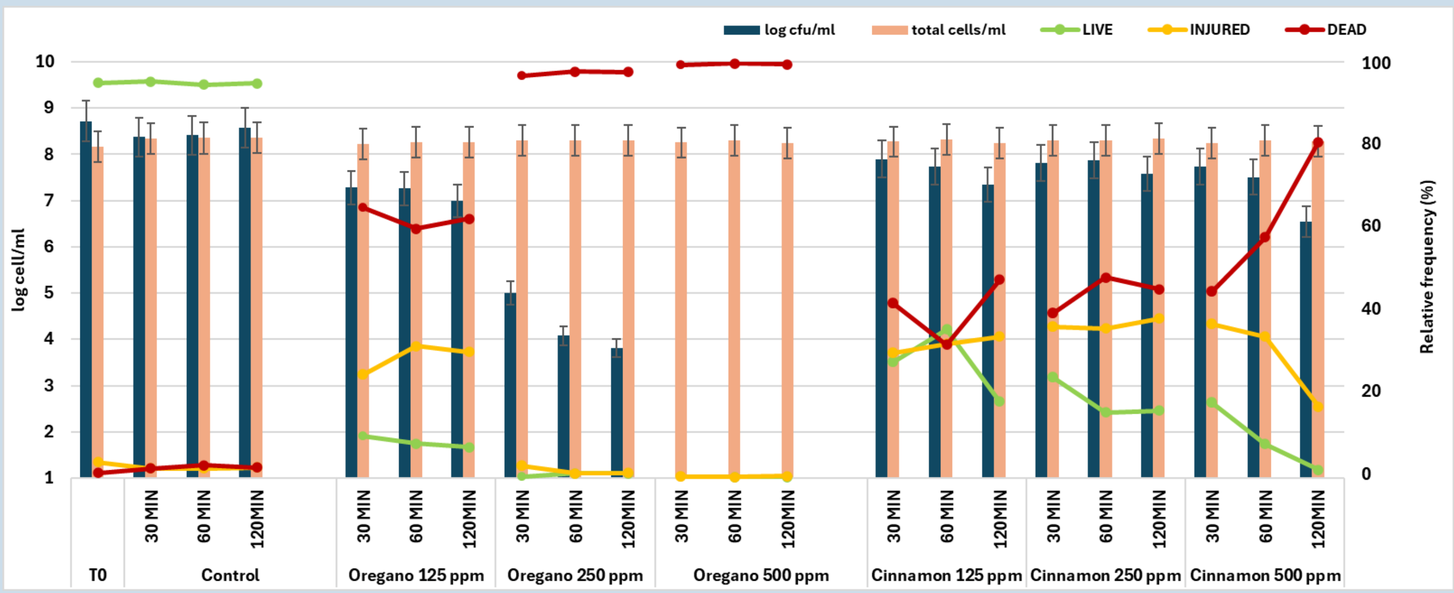

Fig 2. *List. monocytogenes* Scott A behavior in the presence of Oregano and Cinnamon EO tested at different concentrations (125, 250 and 500 ppm) after 30, 60 and 120 min of exposure at 37°C. The histograms represent the comparison between the data of cell culturability (expressed as log cfu/ml) and the total cells detected by flow cytometry (total cells/ml). For these latter, also the relative percentages (%) of viable, injured and dead cells for each condition (as green, yellow and red lines, respectively) are reported

CONCLUSIONS

✓ The results highlighted a promising antimicrobial 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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