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Comparison of the effects of essential oils and antibiotics against *Listeria monocytogenes* isolates

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INTRODUCTION & AIM

- The disease caused by the presence of *Listeria monocytogenes* is mostly transmitted through contaminated food, inadequately pasteurized milk, soft cheeses, fermented sausages, and rarely directly from sick animals
- The increasing resistance of *L. monocytogenes* to antibacterial drugs worldwide is concerning intensifying efforts to find alternative antibacterial
- Many studies showed that essential oils from spice plants could reduce the number of *L. monocytogenes* in food
- This mini study is designed to evaluate the effects of antibiotics and some particularly essential oils on *L. monocytogenes* isolates from food of animal origin and isolates from food-producing surfaces.

METHOD

- *L. monocytogenes* isolates from 1 – fish, 2 – fish, 3 – minced meat, 4 – minced meat, 5 – fresh meat, 6 – minced meat, 7 – surface sample from fish market, 8 – surface sample from fish market, isolated and determined following ISO 11290:2017, including API test (bioMerieux)
- The agar diffusion method was used to determine the antibacterial activity of essential oils on the growth of *L. monocytogenes*
- The following essential oils were used: *Thymus vulgaris, Origanum vulgare, Rosmarinus officinalis, Mentha piperita*
- Furthermore, to test the antibacterial susceptibility of all seven *L. monocytogenes* isolates, the following antibiotics were used: amikacin (30µg), gentamicin (10µg), penicillin (10IU), cephalexin (30µg), ceftriaxone (30µg), tetracycline (30µg), and nalidixic acid (30µg) (Liofilchem, Italy) placed on the surface of the M-H agar
- An inhibition zone was taken from the agar and added to the nutrient broth to assess the mode of action of essential oils on the growth of *L. monocytogenes.* Incubation was carried out at 37°C for 24 hours. If the broth became cloudy after incubation, the action of the essential oil was considered bacteriostatic. If the broth remained clear, the action of the essential oil was considered bactericidal
- ANOVA two-why with replications (Microsoft® Excel 2013) was used for statistical analysis of results.

RESULTS & DISCUSSION

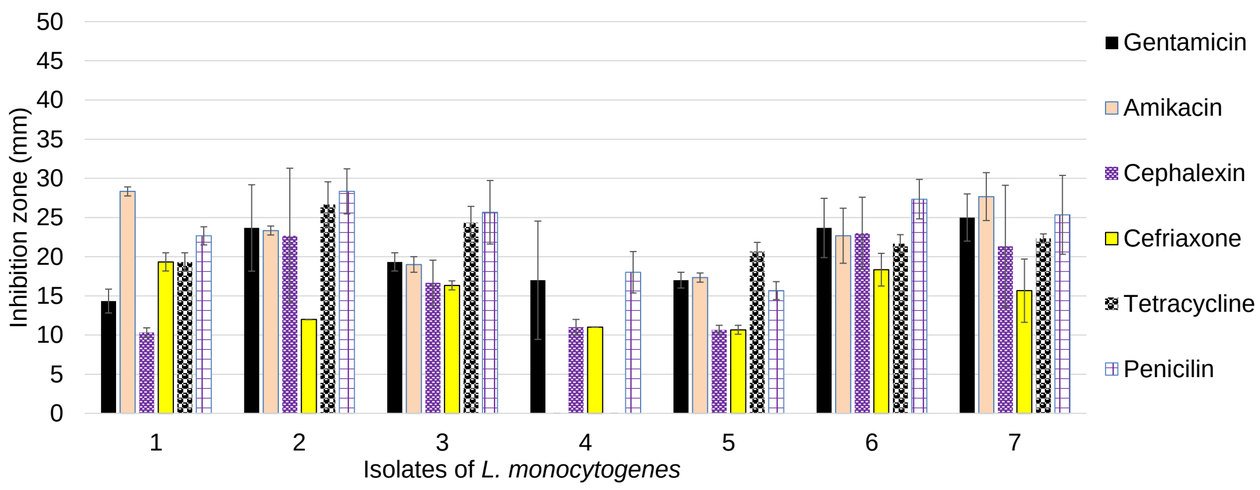

Figure 1. Antibacterial activity of antimicrobial drugs (except nalidixic acid) against *L. monocytogenes* isolates

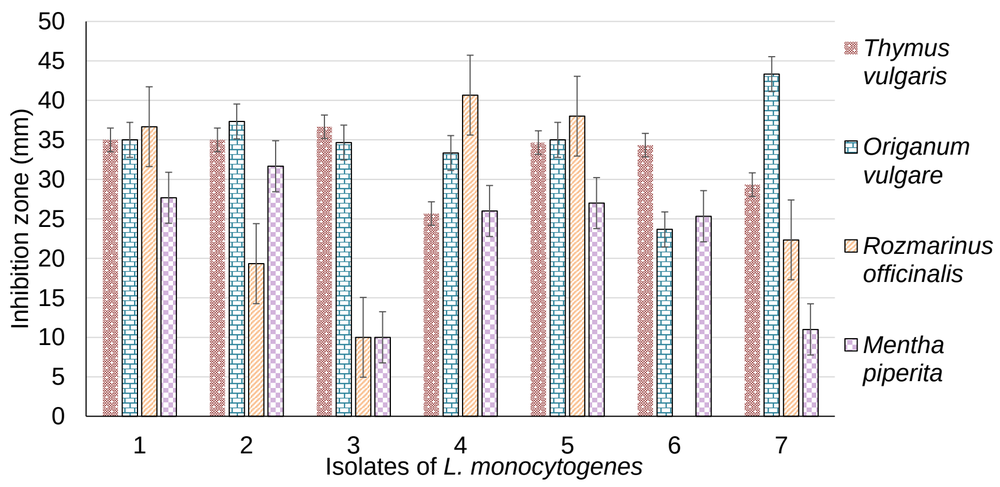

Figure 2. Antibacterial activity of essential oils against *L. monocytogenes* isolates

- In the study (Figure 1) amikacin showed an inhibitory effect on six *L. monocytogenes* isolates with inhibition zone diameters ranging from 17.00mm to 28.33mm. All isolates were 100% resistant to nalidixic acid. Based on the ANOVA calculation, the sources of significant differences in the antibacterial effect ($p<0.001$) are the antibiotics used, the isolates and the interaction between antibiotics and isolates.
- The antibacterial activity of the essential oils of thyme, oregano, rosemary, and peppermint tested on seven isolated strains of *L. monocytogenes* is shown in Figure 2. Based on the ANOVA calculation, the sources of significant differences in antibacterial activity ($p<0.001$) are the essential oils used, the isolates and the interaction between essential oils and isolates.
- The results of evaluating the mode of action of the essential oils on *L. monocytogenes* are shown in Figure 3.
- Thyme essential oil showed a bactericidal effect on all *L. monocytogenes* isolates in all replicates. Rosemary and oregano essential oils showed bactericidal activity against six isolates in all three replicates and peppermint essential oil against five isolates.

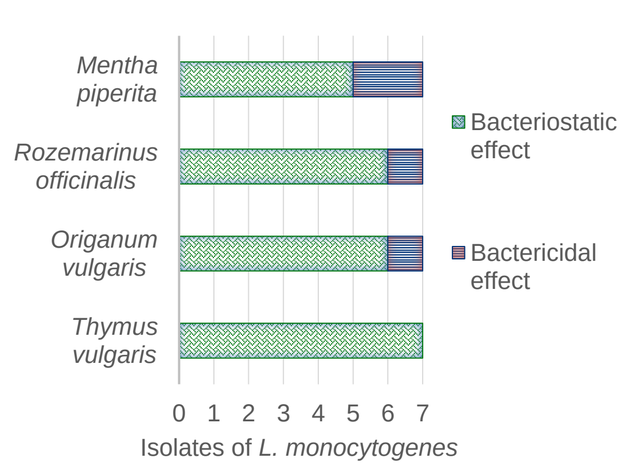

Figure 3. Mode of action of essential oils

CONCLUSION

- ✓ *Results of antibiotic susceptibility testing provide valuable information about the resistance to antibiotics of L. monocytogenes bacteria isolated from food of animal origin and surfaces that come into contact with food*
- ✓ *The L. monocytogenes isolates used in this study showed resistance profiles to multiple drugs and variation in resistance depending on the antibiotic used*
- ✓ *Essential oils compared to antimicrobial drugs showed more pronounced antibacterial activity against L. monocytogenes.*
- ✓ *In particular, it should be emphasized that the essential oil of Thymus vulgaris showed a bactericidal effect against all tested L. monocytogenes isolates*

FUTURE WORK

- *Evaluation of the antibacterial activity of diluted essential oils*
- *Evaluation of the antibacterial activity of essential oils on spiked food samples*