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Comparison of the growth inhibition concentration of 2 antibacterial agents (essential oil blend and antibiotic) against 8 probiotics and 2 pathogenic bacteria strains from monogastric gut flora

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Nowadays, plants' actives are used as preventive and efficient alternatives to antibiotics in animal feed[1]. However, little investigation has been made concerning the spectrum of activity of these molecules among different gut bacteria genus of monogastrics. The aim of this study is to evaluate the in vitro impact of 2 antibacterial agents, a natural essential oil blend (EO mix) and an antibiotic, amoxicillin, on several probiotics and pathogenic bacteria strains.

MATERIAL AND METHOD

Evaluation of the GIC: Growth Inhibition Concentration is the lowest concentration of essential oil blend or antibiotic able to inhibit the bacterial growth for 18h at 37°C.

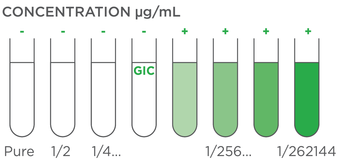
GIC determination of both antibacterial agents: two-fold serial dilutions in liquid broth (Mueller Hinton broth for aerobic strains and broth 20 adapted from Pasteur protocol for anaerobic strains).

Probiotics strains tested: *L. acidophilus* (CIP76.13), *L. casei* (LCR35), *L. para casei* (CIP103704), *L. plantarum* (CIPA159), *B. subtilis* (CIP 52.62), *B. longum* (CIP6462), *L. debrueckii* (CIP101027), *L. rhamnosus* (ATCC53103)

Pathogenic strains tested: *E. coli* (CIP53.126), *C. jejuni* (ATCC 29428)

Bacterial inoculum 5.10^5-10^6 CFU.mL^{-1}

FIGURE 1: ILLUSTRATION OF THE PROTOCOL USED TO DETERMINE EO MIX AND AMOXICILLIN GIC (µg/mL) AGAINST *E. COLI* AND *C. JEJUNI*



RESULT

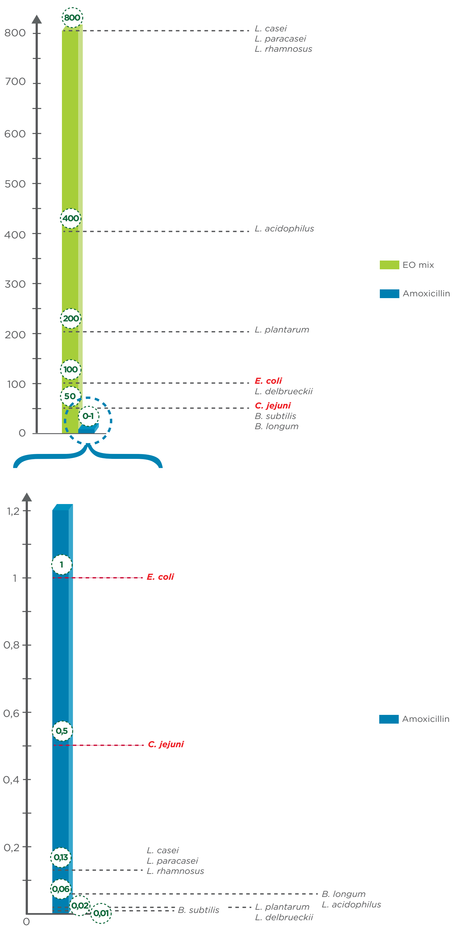
TABLE 1: EO MIX AND AMOXICILLIN GIC (µg/mL) AGAINST *E. COLI* AND *C. JEJUNI* STRAINS

GIC µg/mL BACTERIA/MOLECULES	EO MIX	AMOXICILLIN
L. casei	5 000	0.78
L. paracasei	5 000	0.78
L. rhamnosus	5 000	0.78
L. acidophilus	2 500	0.39
L. plantarum	1 250	0.1
L. delbrueckii	625	0.1
E. coli	**625**	**6.25**
C. jejuni	**312**	**3.13**
B. longum	312	0.39
B. subtilis	312	< 0.05

More sensitive
Less sensitive

FIGURE 2: SCALE COMPARISON OF EO MIX AND AMOXICILLIN GIC (µg/mL) AGAINST *E. COLI* AND *C. JEJUNI* STRAINS AND PROBIOTICS

SCALE: 100 = EO MIX GIC AGAINST *E. COLI* (625 µg/mL)



Essential oil blend GIC: from 312 µg/mL to 5 000 µg/mL

The antibiotic's antibacterial activity is more powerful than that of an essential oil blend

GIC of amoxicillin: from 0.05 µg/mL to 6.25 µg/mL

Essential oil blend GIC of:
- all Lactobacillus strains: from 625 µg/mL to 5 000 µg/mL;
- *E. coli*: 625 µg/mL;
- *C. jejuni*: 312 µg/mL.

Amoxicillin GIC of:
- all Lactobacillus strains: from 0,1 µg/mL to 0.78 µg/mL;
- *E. coli*: 6.25 µg/mL;
- *C. jejuni*: 3.13 µg/mL.

DISCUSSION AND CONCLUSION

These results show that all EO mix GIC determined on Lactobacillus are equal or higher than GIC determined on pathogens (*E. coli* and *C. jejuni*). By opposite, with the antibiotic, all GIC determined on probiotics are lower than GIC determined on pathogens.

Lactobacillus spp seem to be less sensitive to essential oils than pathogen Gram– bacteria as previously described[2-3].

Amoxicillin is more damaging for beneficial gut flora than for pathogenic ones. On the contrary, essential oil blend action is better targeted to *E. coli* and *C. jejuni* strains

We can expect essential oils to target pathogens with a better preservation of beneficial gut flora when amoxicillin antibiotic may negatively disturb the balance of beneficial flora.

This study underlines the difference between both antibacterial technologies. **When plant extract products are more adapted for a preventive use, antibiotics' powerful action is more adapted to a curative use.**

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