THE EFFECT OF BEE PRODUCTS ON GROWTH AND ADHESION OF *CLOSTRIDIOIDES DIFFICILE* STRAINS

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Background

Metronidazole and vancomycin are the drugs of choice for the treatment of *Clostridioides difficile* infection (CDI); however, they are associated with a high incidence of relapses. Increase in therapeutic failures in treating *C. difficile* requires the need for development of alternative therapeutic approaches. Supportive measures are being sought, as well as nutritional diets that inhibit gastrointestinal colonization by *C. difficile* strains. This study aims to investigate the antimicrobial and anti-adhesion activity of bee products against *C. difficile* strains.

Material and methods

Twelve *C. difficile* strains were used in this study: two reference strains (*C. difficile* 630 (RT012) and ATCC 9689 (RT001)), one control strain (*C. difficile* M120 (RT078), and nine clinical strains belonging to the PCR ribotypes: RT027 (n=2), RT023 (n=2) and RT176 (n=5). The minimal inhibitory concentrations (MICs) of Manuka honey (550+), goldenrod honey, pine honey and bee bread for the strains were determined using the broth microdilution method. The effect of bee products on adhesive properties of *C. difficile* to three human epithelial cell lines (HT29, HT29 MTX and CCD 841 CoN) was assessed.

Results

The MICs of Manuka honey for *C. difficile* strains 630, ATCC 9689 and M120, were 6.25 %; 6.25 %; 1.56 % (v/v); for goldenrod honey 50 %; 50 %; 12.5 %; for pine honey 25 %; 25 %; 25 % and for bee bread 100 mg/l; 50 mg/l; 100 mg/l, respectively. The MIC value of clinical strains with given ribotypes was different for the bee products tested and ranged from 1.56 % to 6.25 % for Manuka honey, from 1.56 % to 50 % for goldenrod honey, from 1.56 % to 25 % for pine honey and from 25 mg/l to 100 mg/l for bee bread. Manuka honey (1%) increased the adhesion to the CCD841 cell line of RT176 strains and one strain RT023. Pine honey (1%) increased the adhesion of RT027 to the HT29 cell line. Bee bread (1%) increased the adhesion of M120 strain to HT29 cell line ($p < 0.05$).

• Conclusions

- Bee products showed activity against the tested *C. difficile* strains.
- Sub-inhibitory concentrations of Manuka honey, pine honey and bee bread functioned to increase adhesion by *C. difficile* to the cell lines.
- Further studies are needed to confirm our results.

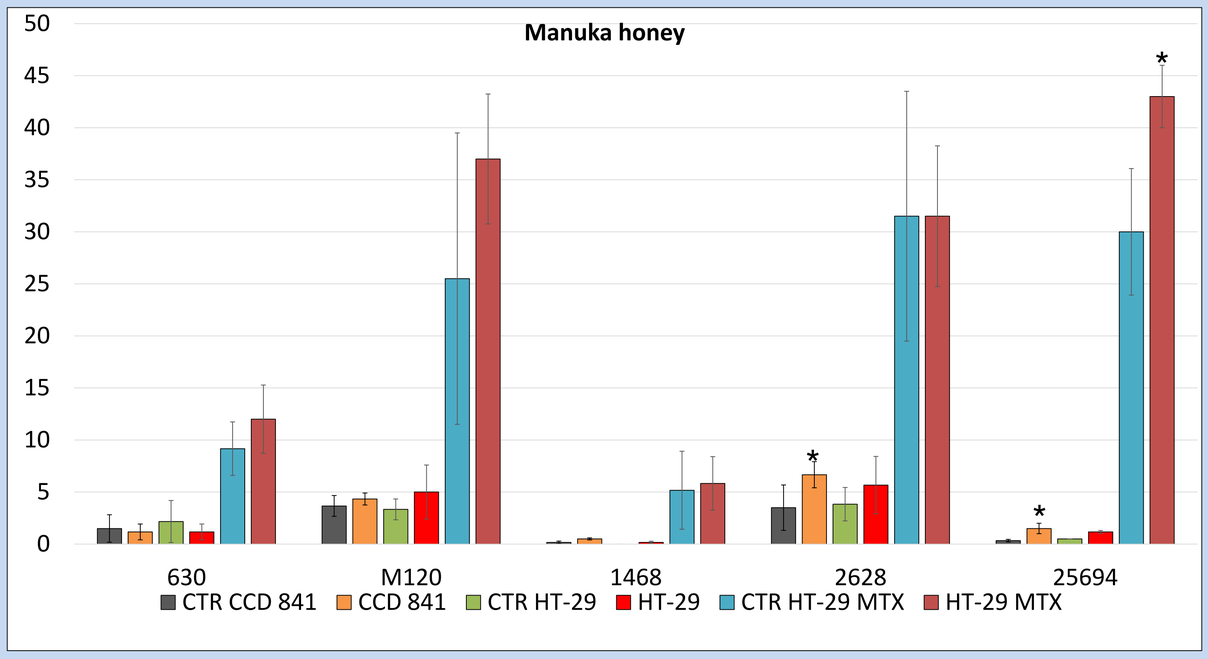

Fig. 1 Effect of Manuka honey on *C. difficile* adhesion to three cell lines: CCD 841 CoN, HT-29 and HT- 29 MTX

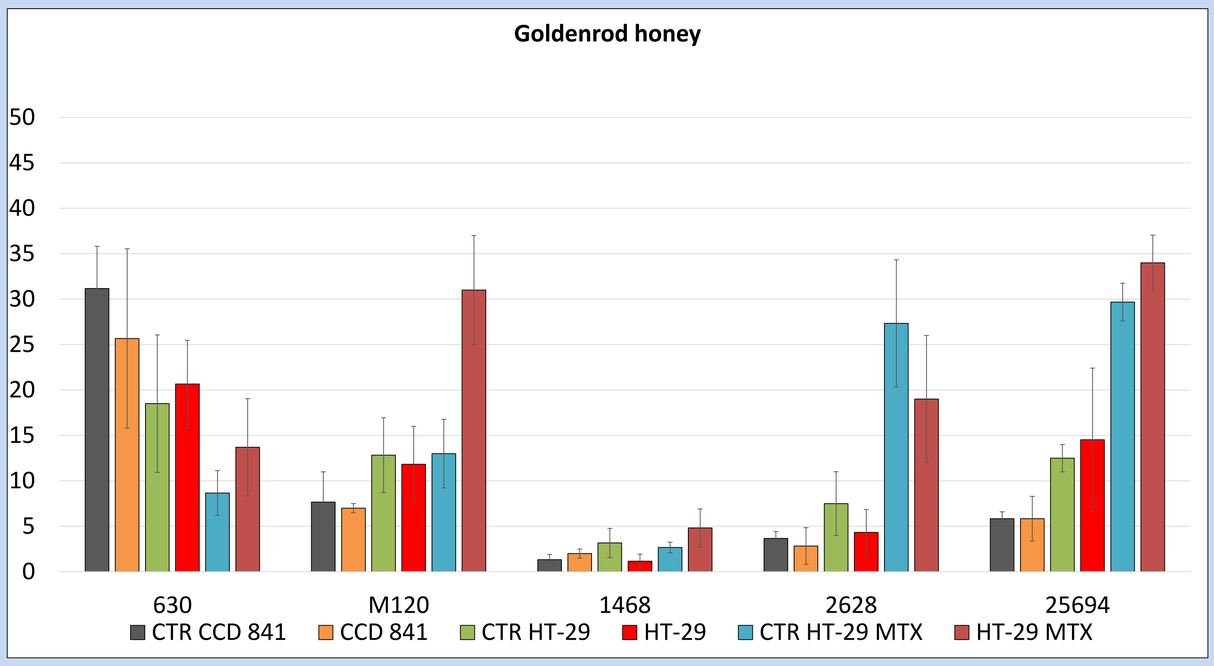

Fig. 2 Effect of goldenrod honey on *C. difficile* adhesion to three cell lines: CCD 841 CoN, HT-29 and HT- 29 MTX

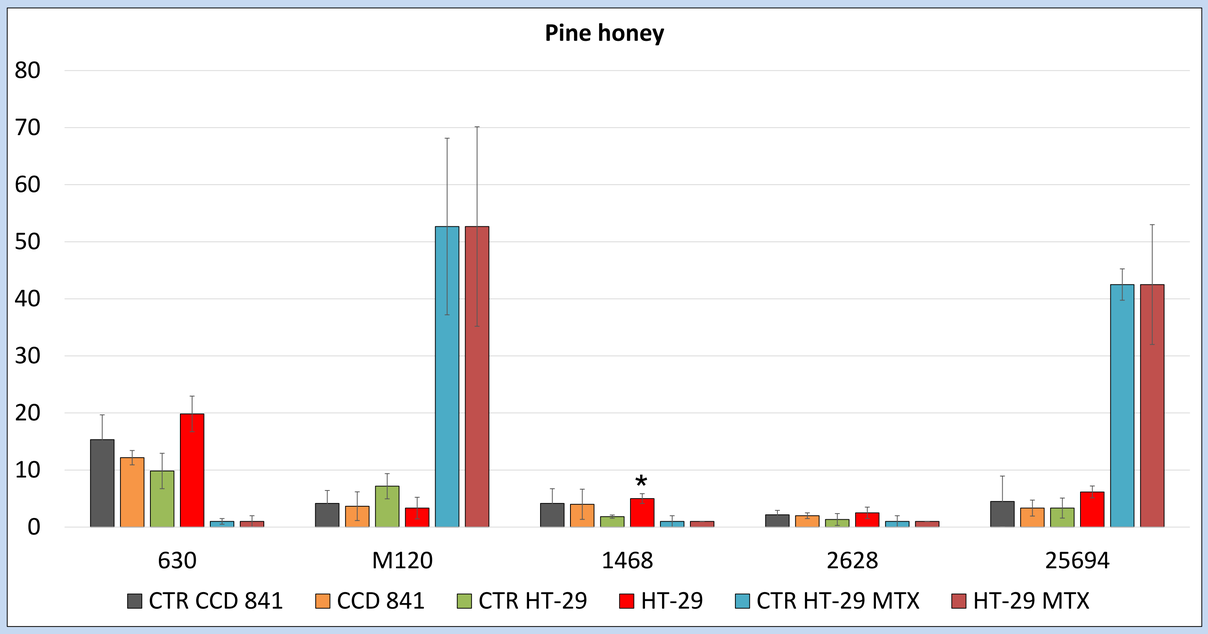

Fig. 3 Effect of pine honey on *C. difficile* adhesion to three cell lines: CCD 841 CoN, HT-29 and HT- 29 MTX

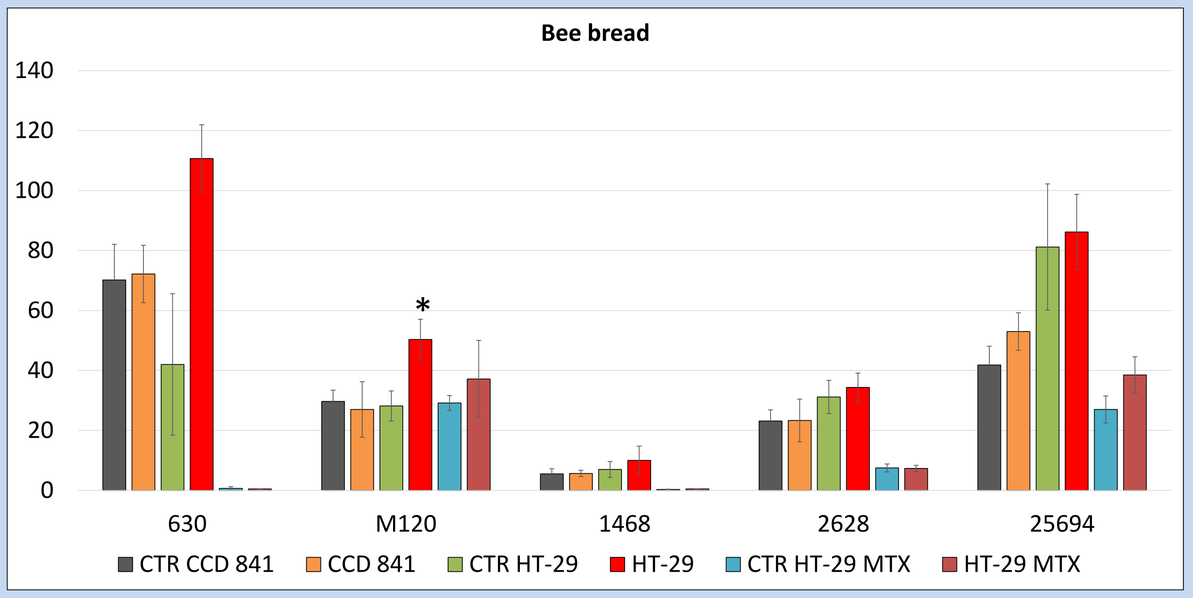

Fig. 4 Effect of bee bread on *C. difficile* adhesion to three cell lines: CCD 841 CoN, HT-29 and HT- 29 MTX

Legend: CTR – control; * - $p<0.05$; error bars shows standard deviation