Potential of *Akkermansia muciniphila* DSM 22959 and *Faecalibacterium duncaniae* DSM 17677 as live biotherapeutics for intestinal infections

Machado, D. (1); Vedor, R. (1); Fonseca, M. (1); Bento, M. (1); Barbosa, J.C. (1); Almeida, D. (1); Andrade, J.C. (2); Gomes, A.M. (1)

(1) Universidade Católica Portuguesa, CBQF—Centro de Biotecnologia e Química Fina—Laboratório Associado, Escola Superior de Biotecnologia, Rua Diogo Botelho 1327, 4169-005 Porto, Portugal (2) TOXRUN—Toxicology Research Unit, University Institute of Health Sciences, CESPU, CRL, 4585-116 Gandra, Portugal.

✉ dmachado@ucp.pt

Introduction: In the last years, human intestinal bacteria, including *Akkermansia muciniphila* and *Faecalibacterium duncaniae*, have emerged as next generation probiotics to be incorporated in foods or delivered in pharmaceutical forms. Despite their multiple health benefits, the inhibitory properties of these probiotics against pathogenic colonization remain poorly studied, mainly due to difficulties in their culture and handling, as consequence of their anaerobic nature.
Objective: Evaluate the potential of type strains *A. muciniphila* DSM 22959 and *F. duncaniae* DSM 17677 to prevent pathogenic colonization.
Methodology: In vitro assays aimed to determine the following properties of these intestinal commensals were performed: i) auto-aggregation and co-aggregation with pathogens, using a spectrophotometric method; ii) biofilm-forming ability, measured through crystal violet staining method; and iii) antimicrobial activity of their supernatants via agar well diffusion. Complementarily, the putative production of antimicrobial compounds of proteinaceous nature was predicted using in silico approaches, namely through the application of BAGEL4 and antiSMASH bioinformatic tools.
Main findings: Both type strains were able to auto-aggregate, and co-aggregate with pathogens, but in different extents. Overall, higher auto- and co-aggregation percentages were verified for *F. duncaniae* DSM 17677. Also, *F. duncaniae* DSM 17677 exhibited a moderate ability to form biofilms, while *A. muciniphila* DSM 22959 was classified as weak producer. Phenotypically, no antimicrobial activity of the type strains supernatants was observed against nine pathogens; a finding that was further corroborated by the in silico analysis.
Conclusion: Our study revealed that both *A. muciniphila* DSM 22959 and *F. duncaniae* DSM 17677 presented key features for their persistence in the intestinal ecosystem and possible prevention of pathogenic colonization and subsequent infection. Therefore, these findings highlight the potential of these human intestinal commensals, mainly *F. duncaniae* DSM 17677, to be used successfully as live biotherapeutic agents against intestinal infections.

Acknowledgments

This work was supported by national funds through Foundation for Science and Technology, I.P. (FCT, IP) including FCT projects references: EXPL/BIA-MIC/0258/2021 and UIDB/50016/2020 and under the Scientific Employment Stimulus—Individual Call (CEEC Individual—CEECIND/00520/2017/CP1404/CT0001).