Characterization of Lacticaseibacillus paracasei ST0110KOC as putative probiotic in healthy human body and hyperthermia conditions

Marcos Vinicio Alves[1], Kayque Ordonho Carneiro[1], Katia Leani[1], SVETOSLAV DIMITROV TODOROV[1,2]

[1.] ProBacLab, Faculty of Pharmaceutical Sciences, University of São Paulo, av. prof. Lineu Prestes 580, Universidade de São Paulo, São Paulo, Brazil;
[2.] CISAS, Instituto Politécnico de Viana do Castelo, 4900-347 Viana do Castelo, Portugal;

The utilization of beneficial bacteria in human nutrition has a long-established history, and today, these beneficial effects are recognized as probiotics. A distinctive feature of certain strains is their ability to produce bacteriocins, which can be harnessed to control pathogenic bacteria. Furthermore, the safety profile of probiotic strains is a critical factor in their selection for potential therapeutic use.

This study aims to investigate the impact of body temperature under normal conditions (37°C) and hyperthermic conditions (39°C) on the growth, safety properties, and bacteriocin production of *Lacticaseibacillus paracasei* ST0110KOC, a strain part of the collection ProBacLab, Laboratory of Food Mcirobilogy, Faculty of Pharmaceutical Sciences, University of São Paulo, Brazil. Growth of *Lbs. paracasei* ST0110KOC at 37°C and 39°C in MRS broth adjusted to different pH levels (2.0, 4.0, 6.0, 8.0, 10.0, and 12.0), was pointed as optimal pH range between 6 and 10 at both temperatures. Moreover, when *Lbs. paracasei* ST0110KOC was cultured in the presence of 0.1% and 10.0% bile salt concentrations and variations of NaCl concentrations (0.5%, 1%, 2.0%, 3.0%, 5.0%, and 10.0%), higher concentration of bile salt and NaCl higher than 5.0% were inhibited tested strain. Exposed to the *in vitro* GIT simulation model, the strain exhibited superior growth at 37°C, with a reduction from 2.5×10? to 2.97×10?, while at 39°C, the decrease was further potentiated, from 2.5×10? to 2.04×10?. Bacteriocin activity of *Lbs. paracasei* ST0110KOC was 51200 AU/mL tested versus *Listeria monocytogenes* 103, 302 and 408. When *L. monocytogenes* 103 was grown in presence of cell free supernatant containing bacteriocin produced by strain ST0110KOC, similar inhibitory mode of action at both temperatures were observed for the first 12h, however, at 24h *L. monocytogenes* presented slight improvement in recovery when cultured at 39°C. Concerning safety properties, *Lbs. paracasei* ST0110KOC was ?-hemolytic, non-producer of gelatinase (none via physiological, neither presence of the *gel* gene), and non-producer of biogenic amines (histamine, putrescine, and tyramine). Moreover, *ace* (angiotensin I converting enzyme) was not detected in DNA from *Lbs paracasei* ST0110KOC. Enzymatic productions recorded for the *Lbs. paracasei* ST0110KOC pointed expression of leucine, valine and cystine arylamidase, acid phosphatase, naphthol-AS-BI-phosphohydrolase, ß-galactosidase, ß-glucosidase and N-acetyl- ß-glucosaminidase. The ß-galactosidase was not expressed in both temperatures. In the antibiogram, the strain exhibited greater resistance to erythromycin at 39°C and to tylosin at 37°C. These findings suggest that temperature may influence critical factors for the use of this strain as a probiotic. This highlights the importance of further research to evaluate its potential use in humans and other animals with varying body temperatures. Understanding the behavior of probiotic strains under different thermal conditions will contribute to optimizing their therapeutic application, ensuring improved effectiveness and safety in clinical settings.

References

Colombo M, Nero LA, Todorov SD. Safety profiles of beneficial lactic acid bacteria isolated from dairy systems. Brazilian Journal of Microbiology, 51, 787-795, 2020.

Fugaban JII, Vazquez Bucheli JE, Kim B, Holzapfel WH, Todorov SD. Safety and beneficial properties of bacteriocinogenic

Pediococcus acidilactici and Pediococcus pentosaceus isolated from silage. Lett Appl Microbiol. 2021 73(6):725-734. doi: 10.1111/la

Acknowledgements: Acknowledgements: FCT (UIDB/05937/2020 and UIDP/05937/2020), FAPESP (2023/05394-9; 2023/14944-2), CAPES (88887.977258/2024-00).