

# Antimicrobial and antioxidant properties of fermented proteins by different lactic acid bacteria strains

Kálmán Botond Süli, Erika Bujna, Firas Alarawi, Quang D. Nguyen



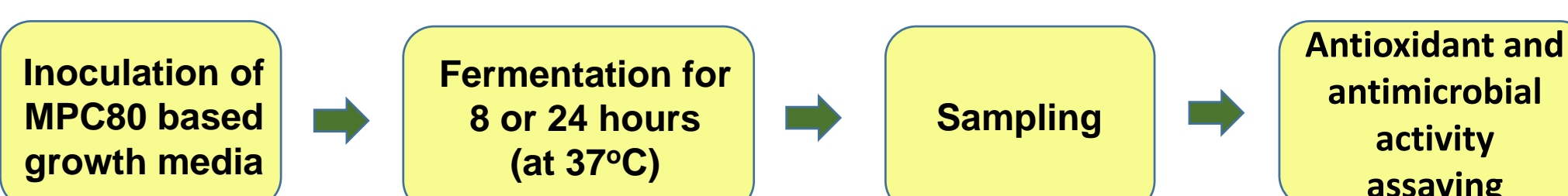
Department of Bioengineering and Alcoholic Drink Technology, Institute of Food Science and Technology, Hungarian University of Agriculture and Life Sciences



## INTRODUCTION

Lactic acid bacteria can hydrolyze proteins by their proteolytic enzymes to release different shorter chain peptides that may have special biological functions, such as immunomodulatory properties, antimicrobial, antiviral or antihypertensive activity. According to scientific literature, the main milk protein fractions - caseins and whey proteins - could be an abundant source of these peptides (Raveschot et al., 2018). In this work, antimicrobial and antioxidant properties of peptides produced by fermentation with *L. delbrueckii subsp. bulgaricus* 397, *L. acidophilus* N2 and *L. 2231<sup>T</sup>* lactic acid bacteria strains were investigated. Four different milk protein concentrate based growth media were utilized for the fermentations, samples were taken after 8 and 24 hours.

## MATERIALS AND METHODS



### Observed bacterial strains

- *Lactobacillus delbrueckii subsp. bulgaricus* 397
- *Lactobacillus acidophilus* N2
- *Lactobacillus 2231<sup>T</sup>*

### Types of fermentation media

The fermentations were carried out on four different type of experimental media:

	Milk protein concentrate (MPC80)	Glucose	Media
A	5g	-	100 mL Distilled water
B	5g	1g	100 mL Distilled water
C	5g	2.5g	100 mL Distilled water
D	5g	1g	100 mL Distilled water, modified MRS (0.25g proteose peptone, 0.2g meat extract, 0.1g yeast extract)

### Antioxidant activity measurement

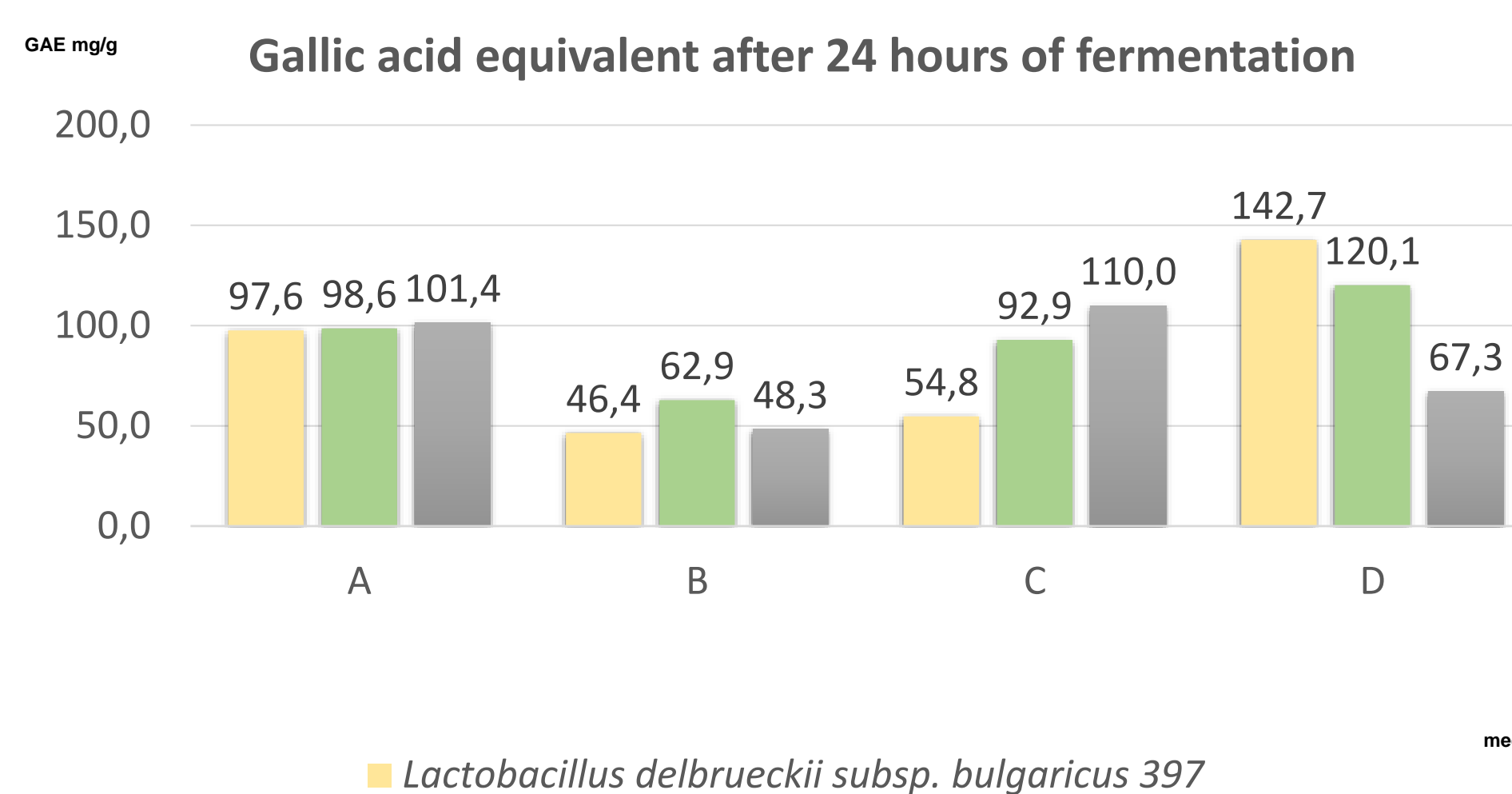
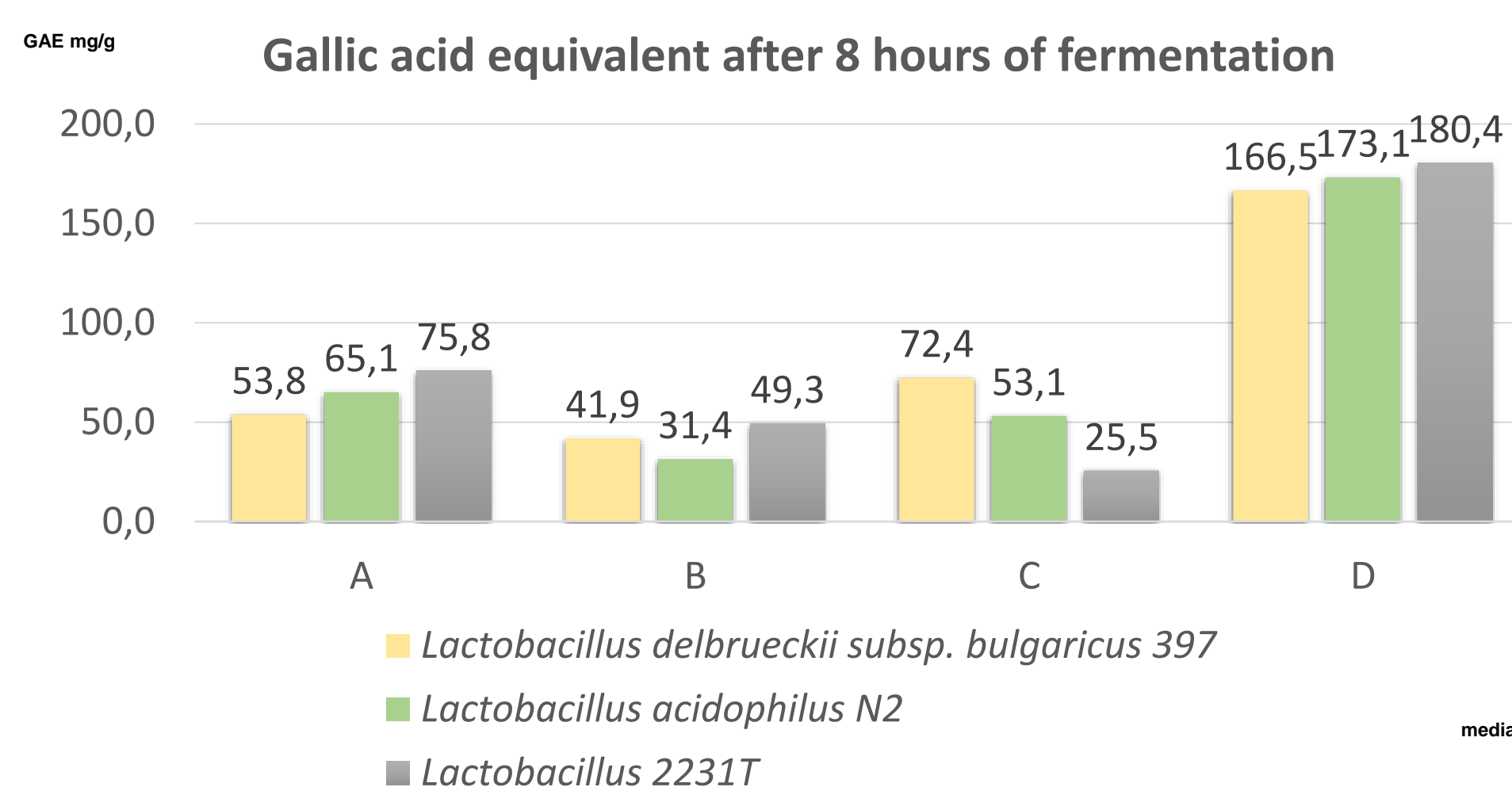
- The applied methodology is based on the comparison of the antioxidant activity of the samples to the activity of gallic acid (Singleton and Rossi, 1965)
- The results are expressed in gallic acid equivalent (GAE)

### Agar diffusion for assaying antimicrobial activity

- *E. faecalis*, *E. cloacae*, *Listeria monocytogenes*, *E. coli* 8739, *E. coli* O157:H7 strains were inoculated on TBS agar media and fermentation samples were pipetted on them.
- After 24 hours on 37 °C the Petri dishes were examined
- Clear zones produced, where the pathogenic strains could not spread due to the antimicrobial activity

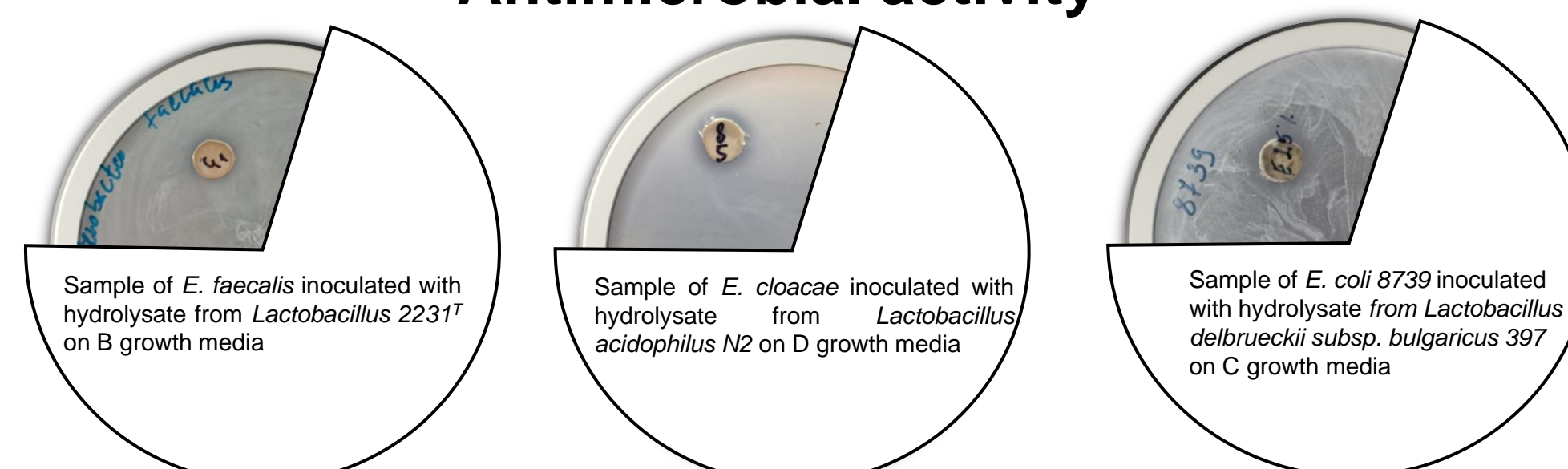
## RESULTS

### Antioxidant values



- The highest antioxidant activity was observed after 8 hours of fermentation in the media where the MPC80 was supplemented with modified MRS (D)
- Addition of glucose had mixed effect on the antioxidant values
- For A, B and C media the longer fermentation time favored the radical scavenging ability

### Antimicrobial activity



Agar diffusion samples of *E. faecalis*, *E. cloacae* and *E. coli* 8739 strains for assaying antimicrobial activity

- The fermented samples were able inhibit the growth of *E. faecalis*, *E. cloacae*, *E. coli* 8739 and *Listeria monocytogenes*
- *Lactobacillus acidophilus* N2 strain was the most effective against the tested pathogens
- Glucose and MRS supplemented growth media enhanced the antimicrobial activity

## CONCLUSION

The antioxidant capacity increased for most fermented samples compared to the untreated MPC80. The highest value was observed in the modified MRS containing complex broth after 8 hours of fermentation with the *Lactobacillus 2231<sup>T</sup>* strain. The hydrolyzed proteins were able to restrain the growth of *E. faecalis*, *E. cloacae*, *E. coli* 8739 and *Listeria monocytogenes*. Generally, the supplementation of growth media was beneficial for both antioxidant and antimicrobial activity, although after 24 hours of fermentation the pure MPC80 also served as a good substrate for production of peptides with antioxidant properties. Despite these results are preliminary, they can serve to understand the capacity of lactic acid bacteria in food technology.

## REFERENCES

Raveschot C., Cudennec B., Coutte F., Flahaut C., Fremont M., Drider D., Dhulster P. (2018): Production of Bioactive Peptide by *Lactobacillus* Species: From Gene to Application, Front. Microbiol., October 2018

Singleton, V. and Rossi, J. (1965): Colorimetry of Total Phenolic Compounds with Phosphomolybdic-Phosphotungstic Acid Reagents. American Journal of Enology and Viticulture, 16, 144-158.

## ACKNOWLEDGEMENT

This work was supported by the New Széchenyi Plant Project No. GINOP\_PLUSZ-2.1.1-21-2022-00048, by the NKFIH Project No. TKP2021-NVA-22; and the Doctoral School of Food Sciences.