Antimicrobial activity of *Lactobacillus plantarum* BG25 against pathogenic microorganisms

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Antimicrobial activity of Lactobacillus plantarum BG25 against pathogenic microorganisms. *The antimicrobial activity of Lactobacillus plantarum BG25 isolated from naturally fermented cereal beverage (boza) against pathogens - Escherichia coli ATCC 25922, Salmonella sp., Klebsiella pneumoniae - through co-cultivation at 37±1°C was examined. It has been found that Lb. plantarum BG25 inhibited the growth of the pathogenic microorganisms and no viable pathogenic cells were established by the 48th or the 60th hour of co-cultivation. It has been shown that the inhibition of the growth of the pathogens was a result of the produced lactic acid and other organic acids which acidified the medium and changed the conditions for the growth of the pathogens.*

Key words: *Lactobacillus plantarum*, antimicrobial activity, pathogens, *Escherichia coli*, *Salmonella*, *Klebsiella*

INTRODUCTION

Probiotics are living microorganisms that confer beneficial effects to the health of the host when administered in adequate amounts [1, 2, 3]. Not all strains of lactobacilli and bifidobacteria can be used as components of probiotics or probiotic foods, but only those which meet certain requirements: to be of human origin, to be non-pathogenic, to be resistant to gastric juice, bile salts; to allow conducting processes in which high concentration of viable cells are accumulated; to be able to adhere to the gastrointestinal epithelium; to produce antimicrobial substances; to be resistant to the antibiotics applied in medical practice; to allow industrial cultivation, encapsulation, freeze-drying and to retain their activity during storage [4, 5, 6]. This requires the mandatory selection of bifidobacteria and lactobacilli strains with probiotic properties.

It is well known that some metabolites - organic acids, hydrogen peroxide, bacteriocins produced by lactic acid bacteria have antimicrobial effect on some pathogenic food-associated microorganisms causing food spoilage. Therefore, the selection of strains with antimicrobial activity is very important. They can be used for the treatment of foodborne diseases, as an ingredient for the preparation of starters for probiotic and functional foods, as biopreservatives.

The purpose of the present study was to determine the antimicrobial activity of *Lactobacillus plantarum* BG25 against *Escherichia coli* ATCC 25922, *Salmonella* sp., *Klebsiella pneumoniae* by co-cultivation of the *Lactobacillus* strain and each of the pathogenic microorganisms.

RESULTS AND DISCUSSION

In co-cultivation of *Lactobacillus plantarum* BG25 with *Escherichia coli* ATCC 25922 at 37±1ºC under static conditions an increase in the concentration of *Lactobacillus plantarum* BG25 cells was observed, at the 12th hour reaching more than 10^{12}cfu/cm^3. In the mixed population the number of cells of *Escherichia coli* ATCC 25922 started decreasing from the beginning of the co-cultivation and at the 48th hour no viable pathogenic cells were detected (Fig. 1a). The observed reduction in the concentration of the pathogen was due to the increase in the titratable acidity, that reached 250ºT at the 48th hour, as a result of the accumulated lactic acid and other organic acids (Fig.1b).

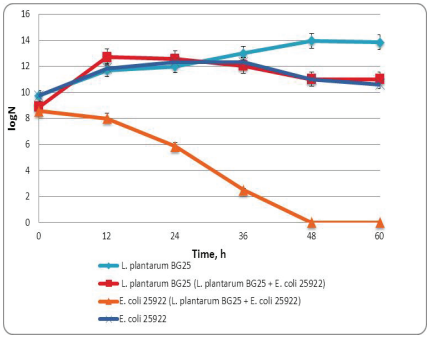

Fig. 1 a) Survival of *Lactobacillus plantarum* BG25 and *E.coli* ATCC 25922 during separate cultivation and co-cultivation at 37±1°C.

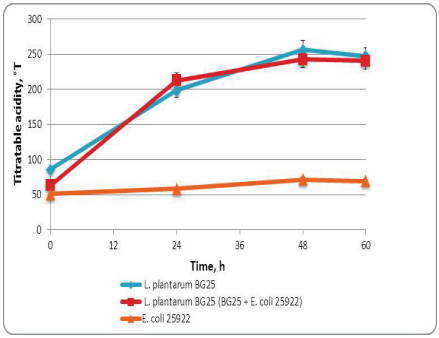

Fig. 1 b) Changes in the titratable acidity of the medium during separate cultivation and co-cultivation of *Lactobacillus plantarum* BG25 and *E.coli* ATCC 25922 at 37±1°C.

In co-culturing of *Lactobacillus plantarum* BG25 and *Salmonella* sp. (clinical isolate) at 37±1ºC, the number of viable lactobacilli cells grew and reached more than 10^{13}cfu/cm^3 at the 48th hour, maintaining its concentration to the end of the process. The concentration of viable cells of *Salmonella* sp. gradually decreased and at the 48th hour no active pathogen cells were detected (Fig. 2). The titratable acidity of the medium reached over 230ºT at the 48th hour which was a result of the production and accumulation of organic acids in the medium (Fig. 2b).

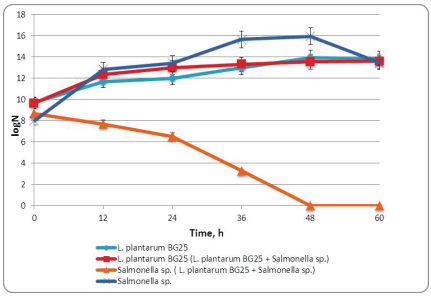

Fig. 2 a) Survival of *Lactobacillus plantarum* BG25 and *Salmonella* sp. during separate cultivation and co-cultivation at 37±1°C.

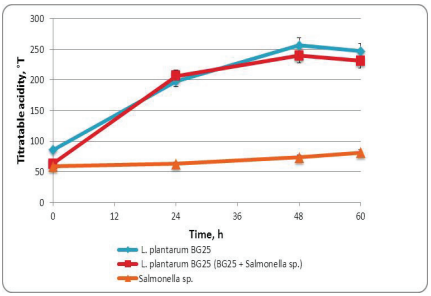

Fig. 2 b) Changes in the titratable acidity of the medium during separate cultivation and co-cultivation of *Lactobacillus plantarum* BG25 and *Salmonella* sp. at 37±1°C.

In the mixed population of *Lactobacillus plantarum* BG25 and *Klebsiella pneumoniae*, the cells of *Lactobacillus plantarum* BG25 retained high activity, and its concentration of viable cells at the 60th hour was 1.10^{14}cfu/cm^3, irrespective of the presence of pathogens, while that of *Klebsiella pneumoniae* was reduced and at the 48th hour no viable pathogen cells were reported (Fig. 3a). The titratable acidity of the medium reached 250ºT at the 48th hour (Fig. 3b).

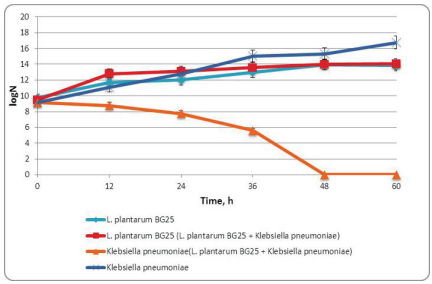

Fig. 3 a) Survival of *Lactobacillus plantarum* BG25 and *Klebsiella pneumoniae* during separate cultivation and co-cultivation at 37±1°C.

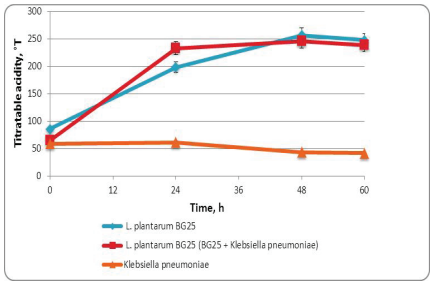

Fig. 3 b) Changes in the titratable acidity of the medium during separate cultivation and co-cultivation of *Lactobacillus plantarum* BG25 and *Klebsiella pneumoniae* at 37±1°C.

CONCLUSION

Lactobacillus plantarum BG25 retained high concentration of viable cells during both separate cultivation and co-cultivation with the pathogens at 37±1°C. *Lactobacillus plantarum* BG25 reduced the concentration of viable cells of each of the pathogens (*Escherichia coli* ATCC 25922, *Salmonella* sp., *Klebsiella pneumoniae*) during co-cultivation and by the 60th hour no viable pathogen cells were reported. The high antimicrobial activity of *Lactobacillus plantarum* BG 25 makes it suitable for use in the formulations of probiotics and starters for functional cereals.

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This paper has been reviewed