

Short Communication

Antibacterial activity of *Lactobacillus bulgaricus* G-LB-44

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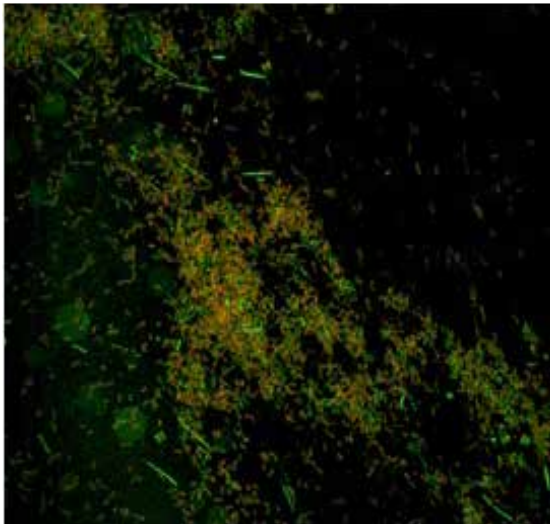
Lactobacillus bulgaricus G-LB-44 was screened for antibacterial activity against (i) different pathogenic species - *Escherichia coli*, *Listeria monocytogenes*, *Staphylococcus aureus*, *Acinetobacter baumannii*, *Enterococcus faecalis*, *Pseudomonas aeruginosa* and (ii) 16 lactic acid bacteria strains and 2 commercially available probiotics using plate counting. All counts were recorded as colony-forming unit per millilitre (CFU/mL). *Lactobacillus bulgaricus* inhibition of *H. pylori* has been initially manifested by Boyanova et al. (2009).

The results showed that *Lactobacillus delbrueckii* subsp. *bulgaricus* G-LB-44 could reduce the growth of potentially harmful bacteria that cause diseases in humans. In most cases, the reduction in the numbers of pathogenic bacteria was greater than 99%. The broad based activity of *Lac-*

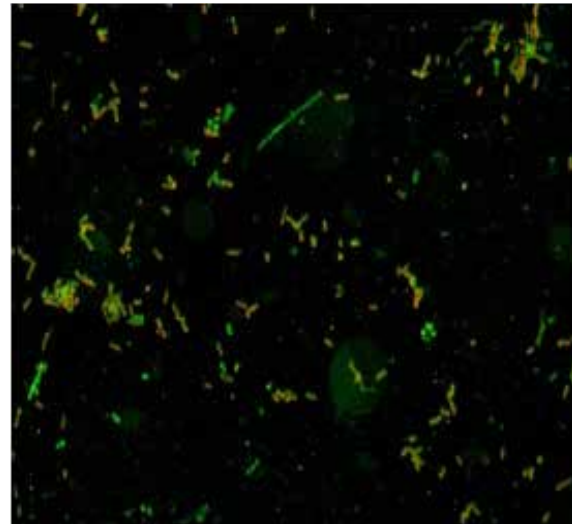
tobacillus delbrueckii subsp. *bulgaricus* G-LB-44 is unusual among *Lactobacillus* species and suggests that there are unique cellular components that may account for this activity. Such compounds are common in nature, however they tend to be directed to very specific strains of other bacteria that compete for nutrients with the probiotic bacteria in a natural setting such as the gastrointestinal tract. It is, therefore, unusual to find a single strain of *Lactobacillus* that produces an inhibitory effect for a broad array of harmful bacteria, since these bacteria would rarely be found at the same time within the same natural setting. Moreover, with regard to other lactic acid bacteria strains and commercial probiotics, no inhibitory activity of *Lactobacillus delbrueckii* subsp. *bulgaricus* G-LB-44 was observed. The study confirms that G-LB-44 is a specific strain

Table 1. Pathogen inhibition by *L. bulgaricus* G-LB-44

Organism	Strain	Inhibition rate; [%]
<i>Acinetobacter baumannii</i>	ATCC 19606	>99
<i>Enterococcus faecalis</i>	ATCC 29200	>99
<i>Enterococcus faecalis</i>	ATCC 29212	>99
<i>Enterococcus faecium</i>	ATCC 51559	>95
<i>Esherichia coli</i>	ATCC 25922	100
<i>Esherichia coli</i>	ATCC 35150	>99
<i>Listeria monocytogenes</i>	ATCC BAA-751	100
<i>Listeria monocytogenes</i>	Clinical Isolate	100
<i>Psuedomonas aeruginosa</i>	ATCC 27853	100
<i>Salmonella typhimurium</i>	Clinical isolate	100
<i>Shigella sonnei</i>	ATCC 325931	100
<i>Staphylococcus aureus</i>	ATCC 12600	>99
<i>Staphylococcus aureus</i>	ATCC 25923	>99
<i>Staphylococcus aureus</i>	ATCC 29213	>98



3 hrs



24 hrs

Fig. 1. Comparison of the whole biofilm structure and the cell density at different time points of the test

of the *L. bulgaricus* and that its inhibitory power against pathogens surpasses other *L. bulgaricus* strains. G-LB-44 is an example of an effective probiotic with suitable scientific substantiation of health benefits.

Lactobacillus bulgaricus G-LB-44 is able to significantly decrease the cell density of *E. coli* biofilm as well as to destroy completely the *E. coli* biofilm structure within a 24 hour period as demonstrated in Figure 1, in images obtained by confocal laser scanning microscopy.

E. coli biofilms growing on glass slides were incubated with *L. bulgaricus* G-LB-44 for 3 and 24 hrs. The bacteria populations were stained with Live/Dead viability kit (Invitrogen) at the end of the incubation period, following the manufacturer's instructions. Fluorescence microscopy images were acquired by a Leica CLSM TCS-SP confocal microscope with a 63.0 X lense. Green short cells: live *E. coli*; red short cells: dead *E. coli*; green long cells: live *L. bulgaricus* G-LB-44.

Since the sub-species of *Lactobacillus bulgaricus* has been safely used in foods for over 100 years with no indications of overdose or side effects, we

believe that the above results indicate the potential of this strain to be used both as a natural preservative capable of inhibiting pathogens in unpasteurized food and as away to replenish the healthy bacteria found in the human digestive system.

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References

- Boyanova, L., M. Stephanova-Kondratenko, I. Mitov (2009). Anti-Helicobacter pylori activity of *Lactobacillus delbrueckii* subsp. *bulgaricus* strains: preliminary report. *Lett. Appl. Microbiol.* **48**: 579-584.