Stimulation of probiotic lactobacilli and bifidobacteria in cultured dairy foods

László VARGA* – Judit SÜLE – Jenő SZIGETI

Institute of Food Science, Faculty of Agricultural and Food Sciences, University of West Hungary, Mosonmagyaróvár, Hungary

Abstract – The primary purpose of this work was to test the effect of bioactive natural substrates on the essential microflora of conventional yogurts and probiotic fermented milks during fermentation and subsequent storage at 4°C. The growth rate, acid production, and viability of *Lactobacillus acidophilus* and *Bifidobacterium* strains during manufacture and refrigerated storage of cultured milks were found to be beneficially influenced by the presence of oligofructose, inulin, honey, and dried *Spirulina platensis*.

Keywords: *Lactobacillus* / *Bifidobacterium* / *Spirulina* / fermented milk

1. INTRODUCTION AND AIMS

Probiotic cultured milks are produced with selected strains of *Lactobacillus* and *Bifidobacterium* species (VARGA 1999). These microorganisms are thought to confer health and nutritional benefits through their activity in the intestinal tract (SURONO & HOSONO 2011). Regulatory authorities around the world are looking for assurance that a probiotic product can deliver viable starter organisms at sufficient number to the large intestine to provide a benefit to the consumer. Levels of at least 10^6 CFU/g to 10^7 CFU/g should be present at the time of consumption if a health claim is to be made (GLÄSER 1992, KRISHNAKUMAR & GORDON 2001). However, various authors have reported that the viability of bifidobacteria is often low in fermented dairy foods (KLAVER ET AL. 1993, HUGHES & HOOVER 1995, LANKAPUTHRA ET AL. 1996, ADHIKARI ET AL. 2000). The objective of this study was to monitor the effects of biologically active natural substances on the characteristic microbiota of cultured milks during fermentation and refrigerated storage at 4°C for up to 6 weeks.

2. MATERIALS AND METHODS

The products tested included yogurt and fermented ABT milks, the latter containing *Lactobacillus acidophilus* (A), bifidobacteria (B), and *Streptococcus thermophilus* (T) as starter organisms.

* Corresponding author: VargaL@mtk.nyme.hu; Institute of Food Science, Faculty of Agricultural and Food Sciences, University of West Hungary, 15-17 Lucsony Street, 9200 Mosonmagyaróvár, Hungary

3. RESULTS AND CONCLUSIONS

The growth, acid production, and survival of probiotic dairy starters during manufacture and subsequent refrigerated storage of fermented milks were improved, although to varying degrees, by the addition of oligofructose (*Figure 1*), inulin (*Figure 2*), honey (*Figure 3*), or the dried biomass of *Spirulina* (*Arthrospira*) *platensis* (*Figures 4 to 7*). The stimulatory or protective effect of these substrates on *Bifidobacterium* spp. is an important finding because bifidobacteria do not grow well in milk and, as was mentioned in the introduction section, they have poor survival rates in conventional fermented dairy foods (KLAVER ET AL. 1993, HUGHES & HOOVER 1995, LANKAPUTHRA ET AL. 1996, ADHIKARI ET AL. 2000). In addition, the substrates tested improved the nutritional and sensory properties of the final products, and some of them also had antifungal effects on spoilage yeasts and molds (*Figure 8*).

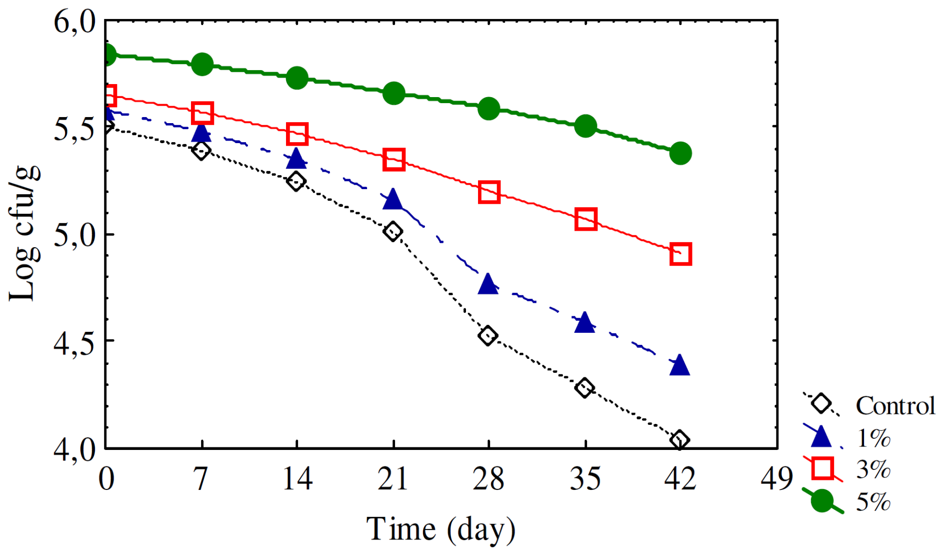

Figure 1. Survival of Bifidobacterium *spp. in oligofructose-supplemented and control fermented ABT milks during storage at 4°C*

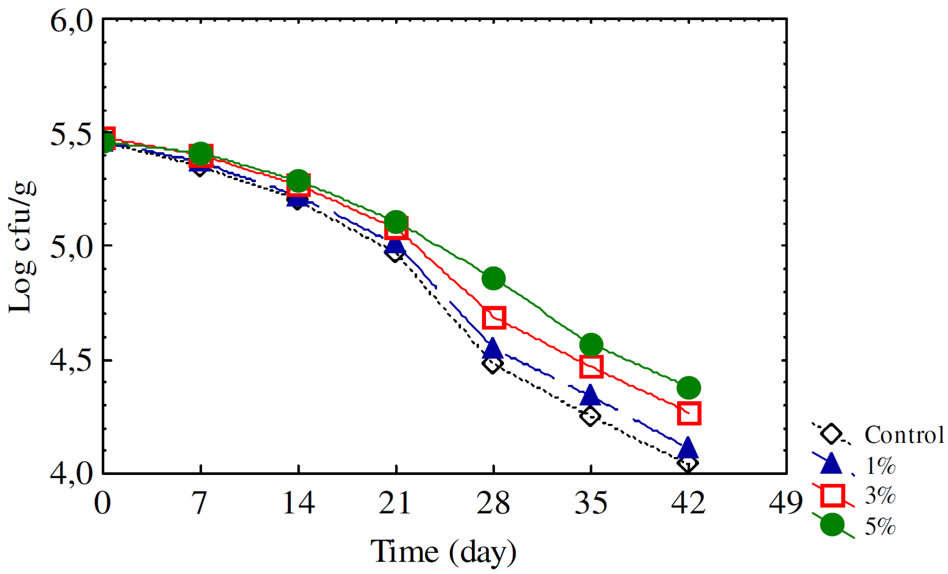

Figure 2. Survival of Bifidobacterium *spp. in inulin-supplemented and control fermented ABT milks during storage at 4°C*

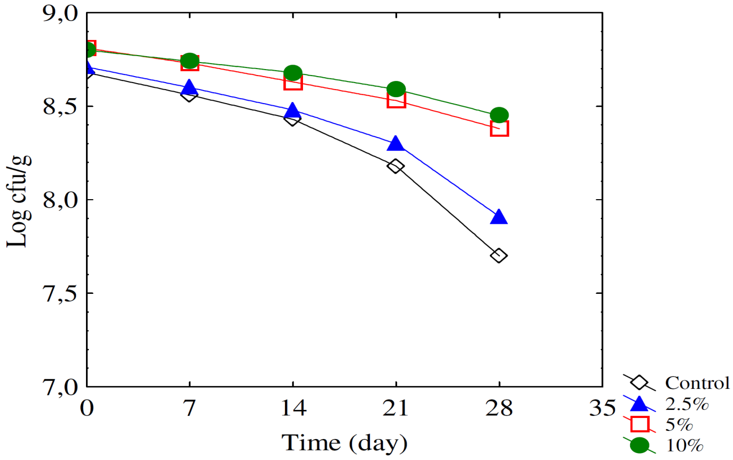

Figure 3. Survival of Bifidobacterium *spp. in honey-enriched and control fermented ABT milks during storage at 4°C*

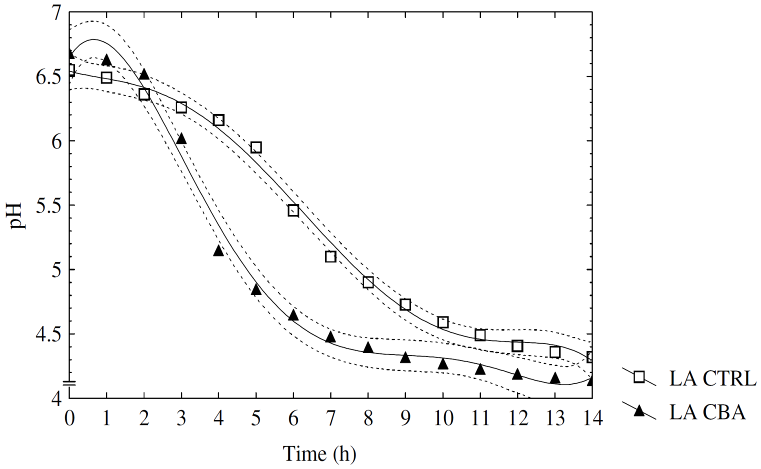

Figure 4. Effect of 0.3% (w/v) Spirulina platensis *cyanobacterial (CBA) biomass on acid production by* Lactobacillus acidophilus *La-5 in milk (CTRL: control)*

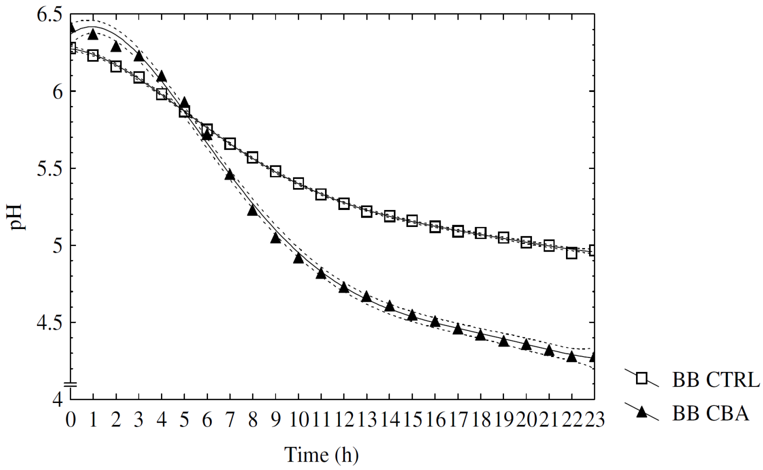

Figure 5. Effect of 0.3% (w/v) Spirulina platensis *cyanobacterial (CBA) biomass on acid production by* Bifidobacterium animalis *subsp.* lactis *Bb-12 in milk (CTRL: control)*

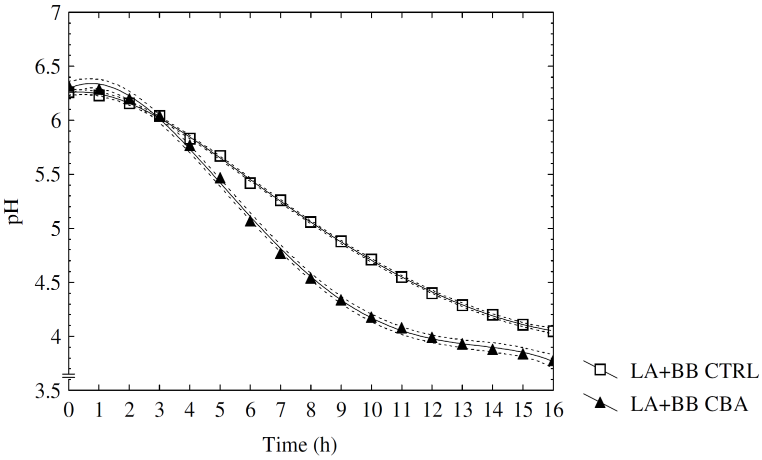

Figure 6. Effect of 0.3% (w/v) Spirulina platensis *cyanobacterial (CBA) biomass on acid production by the mixed culture of* Lactobacillus acidophilus *La-5 and* Bifidobacterium animalis *subsp.* lactis *Bb-12 in milk (CTRL: control)*

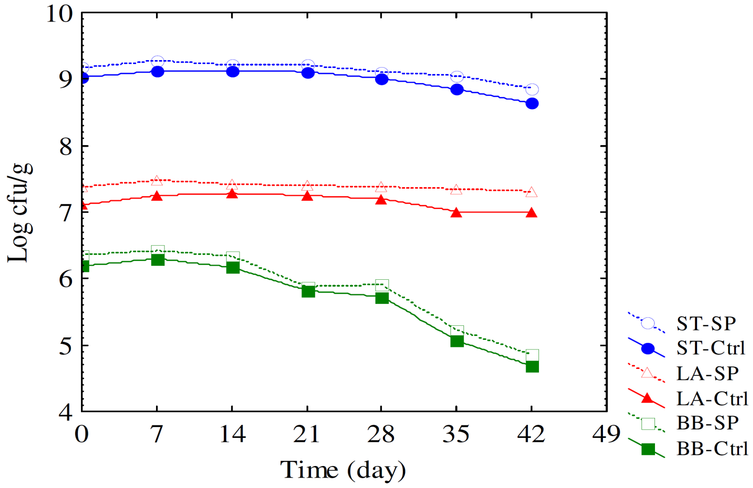

Figure 7. Numbers of surviving Streptococcus thermophilus *(ST),* Lactobacillus acidophilus *(LA) and* Bifidobacterium *spp. (BB) in* Spirulina*-enriched (SP) and control (Ctrl) fermented ABT milks during storage at 4°C*

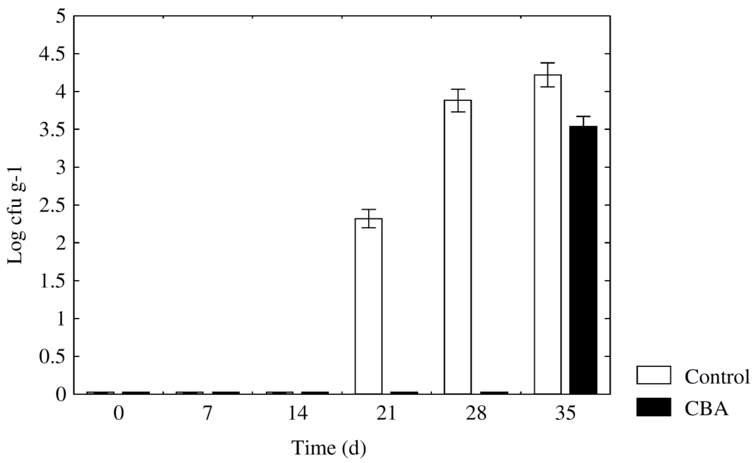

Figure 8. Changes in yeast and mold counts in control and Spirulina*-enriched (CBA) yogurts during storage at 4°C*

Acknowledgments: The authors gratefully acknowledge research funding support from the National Development Agency of Hungary (Project No.: TÁMOP 4.2.1.B-09/1/KONV-2010-0006).

References

ADHIKARI, K., MUSTAPHA, A., GRÜN, I.U. & FERNANDO, L. (2000): Viability of microencapsulated bifidobacteria in set yogurt during refrigerated storage. *Journal of Dairy Science* **83** (9), 1946–1951.

GLÄSER, H. (1992): Living bacteria in yoghurt and other fermented milk products. *European Dairy Magazine* **4** (1), 6–15.

HUGHES, D.B. & HOOVER, D.G. (1995): Viability and enzymatic activity of bifidobacteria in milk. *Journal of Dairy Science* **78** (2), 268–276.

KLAVER, F.A.M., KINGMA, F. & WEERKAMP, A.H. (1993): Growth and survival of bifidobacteria in milk. *Netherlands Milk and Dairy Journal* **47**, 151–164.

KRISHNAKUMAR, V. & GORDON, I.R. (2001): Probiotics: challenges and opportunities. *Dairy Industries International* **66** (2), 38–40.

LANKAPUTHRA, W.E.V., SHAH, N.P. & BRITZ, M. (1996): Survival of bifidobacteria during refrigerated storage in the presence of acid and hydrogen peroxide. *Milchwissenschaft* **51** (2), 65–70.

SURONO, I.S. & HOSONO, A. (2011): Fermented milks – types and standards of identity. In: Fuquay, J.W. – Fox, P.F. – McSweeney, P.L.H. (eds.), Encyclopedia of Dairy Sciences, 2nd edition. Academic Press and Elsevier, Amsterdam, Boston, Heidelberg, London, New York, Oxford, Paris, San Diego, San Francisco, Singapore, Sydney, Tokyo. pp. 470–476.

VARGA, L. (1999): Effect of a cyanobacterial biomass enriched with trace elements on thermophilic dairy starter cultures. *PhD Dissertation*. Pannon Agricultural University, Mosonmagyaróvár, 148 pp.