Omega-3 fatty acids act on Bifidobacterium animalis subsp. lactis survival during storage of organic fermented milks

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Abstract

During the last decades, the organic movement has grown considerably and gained increased public interest. Public concerns have supported the ideas of organic farming, to produce safe food considering the environment and animal welfare. Nowadays, the development of organic probiotic fermented products is of great interest as they associate the benefits of both organic milk (higher amounts of benefic fatty acids, such as trans-vaccenic (TVA), conjugated linoleic (CLA) and alpha-linolenic (ω-3, ALA) fatty acids) and the presence of bifidobacteria. We intend to investigate the effect of type of milk (organic or conventional) on the survival of Bifidobacterium animalis subsp. lactis BB12 (Chr. Hansen) and BL04 (Danisco) during storage of fermented milks at 4∘C. Cultivability (plate counts), viability (epifluorescence detected by flow cytometry) and membrane fatty acid composition (gas chromatography) were measured and compared after fermentation (D1) and after 21 days of storage at 4∘C. From cultivability measurements, the survival was significantly improved in organic milk fermented by BB12 strain after 21 days of storage (+23%). This improvement was lower for BL04 strain (+11%), as compared with conventional milk. The viability of BB12 decreased during storage, but a less pronounced reduction of viable cells was observed in organic fermented milks (from 62±5.8% to 40±2.0% instead of 63%±7.2 to 32±2.7% in conventional milk). Differently, the reduction in viability of BL04 after 21 days of storage was similar in both fermented milks (from 49±5.1% to 44±3.9% in organic milk and from 43±7.5% to 39±4.9% in conventional milk). Analyses of fatty acid membrane composition of each strain revealed differences between the cells grown in organic and conventional milks. By considering BB12 strain at D1, higher amounts of stearic (C18:0), oleic (C18:1) and linoleic (C18:2) acids were found in cells grown in conventional milk, whereas higher levels of myristic (C14:0), pentadecanoic (C15:0) and ALA (C18:3-ω-3) acids were detected in cells cultivated in organic milk. By considering BL04 strain, cells obtained from organic

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fermented milks also contained higher levels of myristic and pentadecanoic acids in addition to oleic acid. At last, variations in membrane fatty acid composition occurred during storage at 4◦C. For BB12 strain, a significant increase in stearic, oleic and ALA acids content took place in organic milk, whereas the levels of pentadecanoic, oleic and ALA acids were augmented in organic fermented milks with strain BL04. It was thus demonstrated that ALA was only present in organic fermented milks, which can be related to the higher survival achieved in organic milk. Finally, from our results, it was concluded that the higher levels of ω-3 ALA contributed to improve the survival of Bifidobacterium animalis subsp. lactis BB12 and BL04 during chilled storage in organic fermented milks. Consequently, as organic and conventional milks differed according to their fatty acid composition, we suggest that a positive relationship exists between the fatty acid composition of the milk and the survival of the bifidobacteria in chilled fermented milks.

Keywords: Organic milk, omega, 3 fatty acids, survival, bifidobacteria