Chapter 3

ANTIMICROBIAL POTENTIAL OF LACTIC ACID BACTERIA

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The preservative effect of lactic acid bacteria during the manufacture and subsequent storage of fermented foods is mainly due to the acidic conditions that they create in the food during their development. This souring effect is primarily due to the fermentative conversion of carbohydrates to organic acids (lactic and acetic acid) with a concomitant lowering of the pH of the food, an important characteristic that leads to an increased shelf-life and safety of the final product. In recent decades, it has become clear that the overall inhibitory action of lactic acid bacteria is due to more complex antagonistic systems produced by the starter cultures. Lactic acid bacteria are capable of producing and excreting inhibitory substances other than lactic and acetic acid. These substances are antagonistic to a wide spectrum of microorganisms, and thus can make significant contributions to their preservative action. They are produced in much smaller amounts than lactic acid and acetic acid, and include formic acid, free fatty acids, ammonia, ethanol, hydrogen peroxide, diacetyl, acetoin, 2,3-butanediol, acetaldehyde, benzoate, bacteriolytic enzymes, bacteriocins and antibiotics, as well as several less well-defined or completely unidentified inhibitory substances (Klaenhammer, 1988; Daeschel, 1989; Lindgren & Dobrogosz, 1990; Schillinger, 1990; Piard & Desmazeaud, 1991, 1992; Vandenbergh, 1993). Some of these substances display antagonistic activity towards many food spoilage and foodborne pathogenic microorganisms, including psychrotrophic lactobacilli and leuconostocs, Bacillus cereus, Clostridium botulinum, Clostridium perfringens, Listeria monocytogenes, Staphylococcus aureus, etc. The competitive removal of essential substrates, the accumulation of D-amino acids, a lowering of oxidation–reduction potential and coaggregation may further restrict undesirable microorganisms. Unfortunately, in some instances the antibiosis will be detrimental by inhibition of other desirable lactic strains composing the mixed starter culture.

The application of appropriate starter cultures for in situ production of antimicrobial compounds in fermented foods and the application of partially purified or pure antimicrobial substances as biological food preservatives in both fermented and non-fermented foods will become much more important in future food preservation as well as in intestinal prophylaxis. This will be all the more true if some difficulties can be overcome, such as: