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## **Fate of *Listeria monocytogenes* in (semi) hard cheese made from starter-induced curds in a microcheese model**

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### **Abstract**

Current models for predictions the development of *Listeria monocytogenes* in cheese use growth rates from mainly (semi) soft cheeses. In previous cheese challenge studies (Colby, Swiss-type, Cheddar and Feta and young Gouda cheeses) growth of *L. monocytogenes* was not observed, and moreover, gradual inactivation after extended ripening times was observed. At NIZO, a microcheese model has been developed that allows for semi-automatic production of 500 semi-hard cheeses of 0.17 g from starter-induced curds per day. This system was used to study the fate of *L. monocytogenes* in semi-hard Gouda cheese. Viable numbers of four individual *L. monocytogenes* strains that were inoculated into cheese milk were determined during curd formation and ripening up to 1 year at 12°C. In addition, pH, organic acid concentrations, NaCl concentrations and moisture content were monitored in time. The outcome of this study was compared with previous (semi)hard cheese studies and cheese model predictions. Upon whey separation, *L. monocytogenes* bacteria were retained in the curd, causing a concentration increase in the curd. No growth was observed in Gouda during the first 6 weeks and a decline in viable numbers was observed afterwards, which is in line with results of previous semi-hard cheese studies. Findings from the microcheese study (*i.e.* no growth of *L. monocytogenes* and data on pH, organic acid concentrations, NaCl concentrations and moisture content) corresponded very well with the outcomes of a previous 4.5 kg Gouda cheese study and with previous semi-hard cheese studies. The microcheese model proved to be a very suitable challenge test system for the fate of pathogens in (semi)hard cheese and very useful to establish inactivation rates for semi-hard cheeses and validate quantitative microbiological risk models.