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INDIVIDUAL-BASED MODELLING AND SIMULATION: TOWARDS A BETTER UNDERSTANDING OF GROWTH DYNAMICS FROM SMALL INOCULA

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The lag phase is one of the main aspects to be considered in extending the safe shelf life of foods. It has mostly been investigated with continuous population models, using rather high inoculum levels. However, foods are often contaminated with just a few microorganisms and, therefore, they demand an individual-based approach. The aim of this contribution is to explore the effect of the inoculum size in population and individual lag phases using an Individual-based Model (IbM). Specifically, we have tackled the dynamics of bacterial and yeast cultures separately, due to the importance of

these microorganisms in food. INDISIM is an IbM designed for modelling and simulation of microbial growth, and it has been already used in the study of different microbial comunities with success. Several simulations changing the initial inoculum size were carried out with INDISIM, covering inocula levels from 1 cell/ml to 1000 cell/ml. These simulations showed that there is no influence of inoculum size in the population lag-parameter, but that there is an effect on other parameters related to lag phase such as first division time and detection time. The analysis of our simulation results showed that classical continuous models were not useful to deal with small inocula because of the excessive influence of the discrete nature of the microbial division. Moreover, we observed that the culture lag time is shorter than the mean of the single cell lags, as has been stated previously in the literature. These preliminary results suggest that INDISIM builds a bridge between individual behaviours and collective observations. It is a helpful tool to acquire deeper understanding of cell behaviour during the first stages of microbial growth, which is a keystone of predictive modelling in food contamination.