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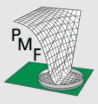

Title

11th International Conference on Predictive Modelling in Food: Book of Abstracts

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sugar content. A variety of nine other pathogenic bacterial species, both Gram-positive and Gram-negative, spore-forming or not, show similar mean thermal resistance and within-species variability. Further research may show that one model, using the same z-values, reference temperatures and prediction intervals for temperature, water activity, pH and other conditions, suffices for the design of thermal inactivation of vegetative cells of many bacterial pathogens.

Keywords: Heat inactivation; bacteria; multiple regression; water activity; statistics

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149: META-REGRESSION MODELS DESCRIBING THE EFFECTS OF ESSENTIAL OILS AND ADDED LACTIC ACID BACTERIA ON L. MONOCYTOGENES INACTIVATION IN CHEESE

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Introduction: Biopreservatives such as plant-based antimicrobials and bacteriocinogenic starter cultures have been proposed as hurdles to increase microbiological safety of cheeses. In this study, meta-regression models were built to summarise the effectiveness of essential oils (EO) and added lactic acid bacteria (LAB) on *L. monocytogenes* (LM) inactivation in cheese, and to evaluate other affecting factors and possible interactions.

Methodology: Suitable primary studies were identified through systematic literature search. From twenty-three studies reporting data on LAB and EO effects on LM counts in cheese, 282 and 322 entries were collected, respectively. The following information was obtained: study ID, antimicrobial class (EO or LAB) and name, LM mean log reduction, storage temperature, exposure time, application type (in milk or on cheese surface), antimicrobial concentration and pathogen inoculum level. Then, mixed-effects linear models with weights were separately adjusted to the LAB and EO data sets, with exposure time and antimicrobial concentration as nested fixed effects in application type.

Results: The results of the meta-regression model for the LAB data set revealed the significant impact of the application type ($p=0.001$), pathogen inoculum level ($p<.0001$) and storage temperature ($p=0.001$) on LM inactivation in cheese; while LAB concentration applied showed no significant effect ($p=0.3688$). An interaction between exposure time and type of application was also observed ($p<.0001$), meaning that the treatment duration, for the same LM reduction, depends if the antimicrobial is added to the milk or to cheese surface.

Regarding the EO-LM meta-model, the results showed, again, the significant effects of pathogen inoculum level ($p<.0001$), storage temperature ($p=0.0004$) and application type ($p<.0001$), the latter meaning that microbial reduction is faster when the EO is added to the milk ($b=0.488$), rather than onto the surface ($b=0.334$). Interactions between application type and exposure time ($p<.0001$) were also observed. Overall, the anti-listerial effect of EOs depends on its origin, yet, seemingly, those extracted from mint,

oregano, salvia and basil present the greatest bactericidal effects in cheese matrix, as per analysis of random-effect marginal intercepts and concentration slopes.

Conclusion and Relevance: Globally, the effect of antimicrobials on LM reduction differs when applied in milk or on the cheese surface, and it is affected by antimicrobial concentration, storage temperature and time. The fact that pathogen's inoculum level consistently appeared as a moderator driving the measured reductions should be further investigated.

Keywords: Biopreservation; meta-analysis; starter culture; antilisterial activity; mixed-effects linear model

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99: DEVELOPMENT OF A GENERAL MODEL TO DESCRIBE *SALMONELLA* spp. GROWTH IN CHICKEN MEAT SUBJECTED TO DIFFERENT TEMPERATURE PROFILES

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Introduction: In this study, a general model to predict *Salmonella* growth in chicken meat subjected to both isothermal and non-isothermal temperature profiles was developed and validated.

Methodology: To accomplish this task, three different primary (Baranyi-Roberts, Huang, and Robazza et al.) and three different secondary (Ratkowsky et al., Huang, and Rosso et al.) models were taken from the literature and tested against 250 isothermal datasets regarding *Salmonella* growth in chicken meat selected from Combase. The following statistical indices were considered to compare the models: Akaike Information Criterion, Bayesian Information Criterion, Accuracy Factor, Bias Factor, Mean Absolute Error, and Root Mean Square Error. The resulting model comprising the primary and secondary models that provided the best fit to the selected data sets was numerically integrated and validated against 4 non-isothermal temperature profiles of Salmonella growth in chicken meat also selected from the literature. After the validation, a few simulations were conducted to evaluate the influence of small temperature shifts corresponding to situations of temperature abuse in chicken meat on the *Salmonella* population. Two empirical equations that predict the time to a 1-log and a 2-log increase in the bacterial loads in terms of the amplitude of the temperature shift were obtained.

Results: The primary model of Huang was considered to provide the best fit, and the Ratkowsky et al. and Huang secondary models were considered to be the best secondary models to describe the experimental data. The minimum temperature for *Salmonella* growth was empirically estimated to be approximately 6 °C. In addition, it was observed that the time to 1-log and 2-log increases were of approximately 96.7 and 188.0 hours respectively in a scenario corresponding to a shift of 0.5 °C in relation to an initial