

USE OF PREDICTIVE MODELLING SOFTWARE IN THE EVALUATION OF CORRECTIVE ACTIONS, HACCP PLANS, WITHIN ARTESANAL DAIRY PRODUCTS

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INTRODUCTION

The food safety system of Hazard Analysis and Critical Control Points (HACCP) is mandatory since January 2006. The EU Regulation 852/2004 states that flexibility is necessary when dealing with traditional production processes, but this should not compromise food hygiene objectives. Predictive modelling is considered a valid tool for evidencing to the official authorities the compliance with microbiological criteria, in Regulation 2073/2005.

This study aims to apply predictive microbiology tools to evaluate the safety of traditional cheese in the event of a malfunction in the refrigerated storage equipment.

METHODOLOGY

- Samples from different producers were taken and pH and water activity were measured.
- i) Comparative analysis of physico-chemical data between different types of artisanal cheeses;
- ii) Case-study of a temperature abuse during refrigerated storage and subsequent evaluation of product safety, assuming a worst case scenario.
- The microorganism of concern was *Listeria monocytogenes*.
- A prediction was made using the software ComBase Predictor, for a given set of conditions (variable temperature, fixed a_w and pH).
- The value h_0 means the physiological state of the initial cells, being h_0 the worst-case scenario
- Storage temperature of a real production facility was recorded, simulating equipment malfunction.

RESULTS AND DISCUSSION

Reg. n°2073/2005

Foods **unable** to support the growth of *L. monocytogenes*

$a_w < 0.92$ or
pH < 4.4 or
pH < 5.0 and $a_w < 0.94$

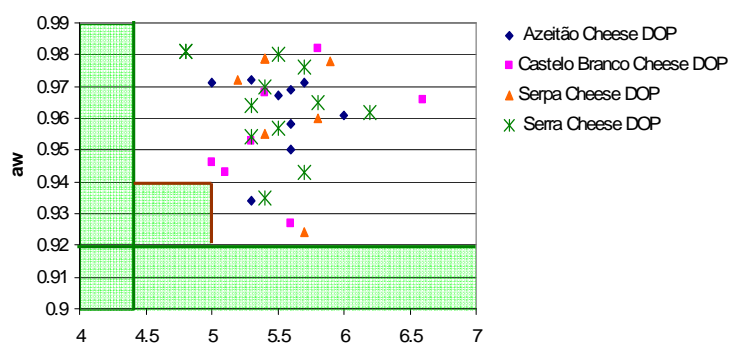


Fig.1 Comparison of pH and a_w results of the samples with EC Reg.2073 criteria

Figure 1 indicates that 100% of the samples **are able** to support growth of *L. monocytogenes*.

L. monocytogenes has been detected frequently in cheeses produced with raw milk, specially soft cheeses (data not shown). Taking as example the “Serra da Estrela” cheese, this pathogen has been detected in 3 out of 12 cheeses purchased in commercial surfaces. The *L. monocytogenes* concentration in these 3 cheeses varied between 10 and 30 CFU/g.

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RESULTS AND DISCUSSION (cont.)

Case Study

In the storage of final products, there are several “Serra da Estrela” cheeses in different stages of curing. Fig. 2 compares the growth of *L. monocytogenes* in a cheese with longer curing time (pH 4,8; a_w 0,935), “Serra da Estrela” 1 cheese and other, softer, identified as “Serra da Estrela” 2, (pH 5,4; a_w 0,981).

An initial contamination level of 10 CFU/g was assumed.

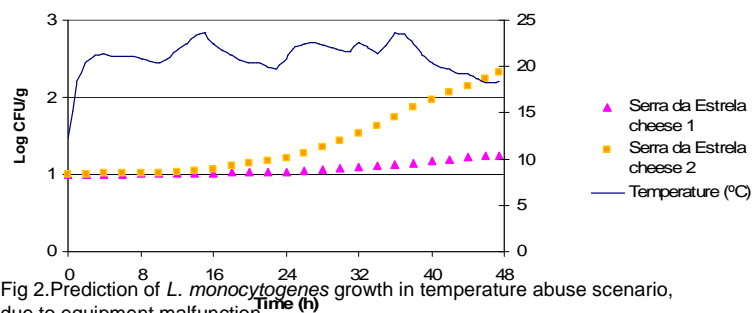


Fig 2. Prediction of *L. monocytogenes* growth in temperature abuse scenario, due to equipment malfunction.

After 48 h, in “Serra da Estrela” 1 cheese the pathogen growth would not be a concern, but in “Serra da Estrela” 2 cheese, it would exceed legal limits. This evaluation would allow to focus financial resources, concentrating further analyses in the more susceptible lot.

For “Serra da Estrela” 1 cheese, there is an increase of 25% in the predicted *L. monocytogenes* concentration, still within the legal limits. This product could be sold, but the producer should reduce its shelf time, in a way that assures that by this time, the legal limit of 100 CFU/g would not be exceeded.

CONCLUSIONS

- ComBase is a user friendly, cost effective tool to evaluate the microbial behaviour in different circumstances.
- In any approach, care should be taken as the models developed for ComBase were mainly obtained from experiments performed in liquid medium, not considering the effect of the food matrix.
- As a first approach, it is an interesting decision making tool when safety limits are exceeded and corrective actions need to be taken, without expensive, and time consuming analytical testing.
- In other processing steps that might have an important or critical impact on food safety, decisions should not be made based upon predictive microbiology only, unless very specific models are used.