PREDICTING GROWTH OF SALMONELLA IN FRESH PORK PRODUCTS

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Introduction

• Several studies have shown that contamination of minced meat with *Salmonella* is still considered a major problem for food safety (Berends et al., 1996; Wegener and Baggesen, 1996; Kasbohrer et al., 2000; WHO, 2001; Bolton et al., 2003; Maasen & Stolle, 2005);

• Models developed with sterile broth do not always provide relevant predictions of pathogen growth in non-sterile and non-homogeneous food (Ross, 1996);

• Thus, there is a need to develop models for growth of pathogens in food with the natural microflora present (Oscar, 2007).

Objective

✓ The strategy of this work have been to build scenarios for baseline temperature abuse as well as for the presence of a natural microflora in fresh pork meat in order to predict the growth potential of *Salmonella* in fresh pork products.
Material and Methods

Fresh Pork Products

Sterile meat

Meat with a natural microflora

Salmonella typhimurium cocktail

Storage at different
[Temperature (°C) / Time (h)]

At least 8 points of sampling
during storage

Analysis of Salmonella by drop plate
incubated for 16-24h at 37°C in XLD

Drop-plated onto:
- Plate Count Agar (incubation at 20°C for 3 d) to obtain an estimate of the level of psychrotrophic bacteria;
- MRS agar (incubated anaerobically at 30°C for 48 h) to obtain an estimate of the level of lactic acid bacteria;
- MacConkey agar (incubation at 37°C for 24 h) to obtain an estimate of the level of Enterobacteriaceae per gram of the meat.

Data analysis:
The growth model described by Baranyi and Roberts (1994) was fitted using MicroFit (version 1.0)
Results and Discussion

- Faster growth of *Salmonella* was observed in sterile meat at the temperatures below 20°C;

![Graph](image)

**Fig. 1** – Growth curves of *Salmonella* in fresh pork meat at different chilled temperatures

- The results confirmed that the competitive natural microflora in minced pork can reduce growth of *Salmonella* as previously observed for incubation of food samples in enrichment broths (Beckers et al, 1987; Rhodes et al, 1985; Stecchini et al, 1988);

- The same effect was also detected by Oscar (2006) in a study concerning prediction of growth for *Salmonella Typhimurium DT104* in ground chicken breast meat with a competitive microflora.
Results and Discussion

Fig. 2 compares the effects of storage temperature on the generation time of *Salmonella* in sterile and naturally contaminated fresh minced pork meat;

Generation times of *Salmonella* in pork meat could not be predicted satisfactory from literature models developed in chicken meat (Oscar, 2006 & 2007);

Fig. 2 – Generation time of *Salmonella* during chilled storage of fresh pork meat
Results and Discussion

The largest deviations between predicted and observed values were found when comparing pork and chicken meat with a natural microflora pointing out that it was necessary to develop new predictive models specifically for *Salmonella* in fresh pork with a natural microflora in order to approve accuracy of predictions;

Therefore, preliminary secondary models were developed for describing the effect of temperature on the maximum specific growth rates found in this study. Predictions from these models indicated that below 15°C, the natural microflora of fresh pork meat slowed down the generation time of *Salmonella* with more than 2-fold.
Results and Discussion

✓ In the same temperature area, significant increase of Salmonella was observed before the fresh pork meat with a natural microflora was rejected for consumption (Tab. 1 & Fig. 3);

✓ The growth was most pronounced around 15°C, where an increase in Salmonella count of more than 1 log-unit was found, but also at 12°C and 20°C Salmonella was observed to initiate growth before the meat was spoiled (Fig. 3).
Conclusions

- At temperatures below ~15°C, the natural microflora of fresh pork meat reduced growth of *Salmonella* considerably;

- At temperatures around ~15°C, significant growth of *Salmonella* was observed before the meat was rejected for consumption on the basis of odour and appearance;

- This indicated that safety, rather than spoilage, could be the shelf-life limiting factor of fresh pork meat at these abusive storage conditions.