FHM-061BM: Dietary microbial exposure: Relation with allergies?

Keywords:	allergies, nutritional micro-organism load, food habits
Supervisors:	Marcel Zwietering (marcel.zwietering@wur.nl) Berber Vlieg-Boerstra (OLVG, hospital), Jeanne de Vries (jeanne.devries@wur.nl)
Project duration:	MSc: 4–6 months; BSc: 4 months (4 months thesis includes no or limited lab work)
Specialisation:	MBT B/C, MFT A/E, MFS A/C

Project description:

Background:

Declining microbial exposure is suggested as a major cause for the increase in allergic disease in recent decennia. This concept has been based on the "hygiene hypothesis" in which it is hypothesized that frequent infections in early childhood could be protective for the development of allergic disease. Over the years, the focus on microbial exposures has widened from the influence of pathogenic microbes causing infections towards non-pathogenic types of strains (commensals and environmental strains) and components of microbes such as bacterial endotoxins by farm living. In parallel with the potential association of microbial load and the increase in the prevalence of allergic disease in the past decennia, food habits have changed dramatically. However, there are no data available on the total microbial exposure of our diet. In earlier theses, we identified foods contributing to 95% of the total microbial load and developed a food frequency questionnaire (FFQ) for assessment of the dietary microbial content of the diet.

To follow-up these studies, we aim to:

1. Study factors influencing on minimum and maximum microbial contents and to incorporate these factors into the FFQ;
2. Evaluate the FFQ on the individual level;
3. To qualitatively describe differences between our actual food habits and those of several decennia ago, and the suspected effect on the dietary microbial exposure;
4. To quantitatively compare the microbial load of the Dutch National Food Consumption Survey 2003 with the diet used several decennia ago.

Activities**:**

Literature research, recruitment of participants, development and validation of an instrument by sampling and analysis of duplicate foods, statistical analyses using SPSS, report and presentation.

FHM-062BM: Prediction of spoilage of fresh poultry meat under dynamic temperature regimes

Keywords:	*shelf life fresh poultry meat, Pseudomonas ssp., cold chain, temperature abuse*
Supervision:	Masja Nierop Groot (FBR) (masja.nieropgroot@wur.nl) Martijntje Vollebregt (FBR) (martijntje.vollebregt@wur.nl) Marcel Zwietering (WU) (marcel.zwietering@wur.nl)
Project duration:	MSc: 4–6 months; BSc: 4 months (4 months thesis includes no or limited lab work)
Specialisation:	MBT B, MFT A, MFS A/C

Project description:
To control the spoilage of fresh poultry meat, it is of importance to control the temperature in the chain starting from production and distribution to storage at home of consumers. Predictive models could help to understand the impact of temperature on shelf life of products. Moreover, it allows prediction on the effect of interventions on the shelf life. This project aims to develop a predictive shelf life model for fresh poultry meat as a function of temperature. The project will be executed in collaboration with a Dutch producer of fresh poultry meat.

The following activities are foreseen in the project:

1) *Construction of a predictive shelf life model for fresh poultry meat*

Models that predict the growth of the spoilage microorganisms *Pseudomonas* sp. on fresh poultry meat as a function of temperature will be constructed.

2) *Validation of the predictive models*

The predictive shelf life model for fresh poultry meat will be validated in practice. the predicted shelf life of fresh poultry meat stored at different temprature regimes will be compared to the observed shelf life.

3) *Effect of interventions on the shelf life of fresh poultry meat*

Using the model developed under 1) the effect of interventions aiming for reduction of inital on shelf life can be predicted. Intervention than can be included are for example altered cleaning and desinfection regimes, use of UV or pulsed light treatment. Depending on the availability of literature data, relevant input dat can be obtained from literature, historical data present of the producing industries or should be experimentally determined.

Project duration
This project could be executed as a MSc thesis project (6 months) at Food and Biobased Research or as a practical training (6 months) at Food and Biobased Research. In the latter case, a stay at the poultry meat producing industry is an option.

References:
Bruckner et al. (2013). A preductive shelf life model as a tool for the improvement of quality management in pork and poultry chains. Food Control 29: 451-460.

Sylvain Dabadé et al. (2015). Prediction of shelf life of tropical shrimp (*Penaeus notialis*) under dynamic temperature regimes. Int. Journal of Food Microbiology 210: 121-130.

FHM-063BM: Effects of produce washing with sanitizers: Exploring risk assessment strategies

Keywords:	meta-analysis, variability, food safety objective
Supervisors:	Marcel Zwietering (marcel.zwietering@wur.nl) Jen Banach (jen.banach@wur.nl)
Project duration:	MSc: 4–6 months; BSc: 4 months (4 months thesis includes no or limited lab work)
Specialisation:	MBT B, MFT A/E, MFS A/C

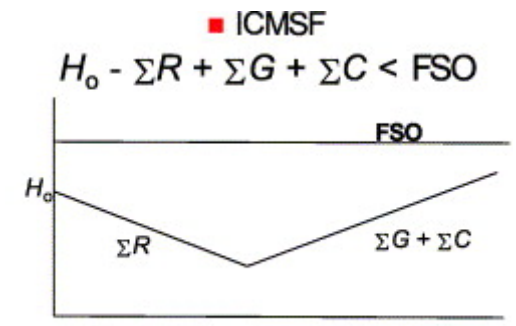
Project description

Background:

Incidents with pathogens in the fruit and vegetable chain, such as the Shiga toxin-producing *Escherichia coli* (STEC) strain outbreak in 2011, has led to a damaged image and loss of consumer confidence in the European horticulture sector. Currently, the extent to which pathogens in produce actually pose a threat to human health is ill-defined. The challenge with fresh produce are the missing effective disinfection strategies to eliminate pathogens while retaining product quality, meaning washing remains the critical step to ensure food safety. Washing, however, brings the chance for pathogen cross-contamination unless additional measures – like the use of chemical sanitizers – are applied. Application and monitoring of the process washing water with chemical hurdle technologies could help prevent and control microbial cross-contamination within the washing water (1).

Activities:

- Perform meta-analysis on the inactivation profile of relevant pathogens including among other factors the use of sanitizers like chlorine dioxide and peracetic acid.
- Evaluate and apply the food safety objective (2) in scenarios such as with *E. coli* and *Salmonella* spp. in the fresh-cut lettuce chain.



FSO: Food Safety Objective (cfu/g or prevalence)

Source: Zwietering (2005)

1. Banach, J. L., Sampers, I., Van Haute, S., & van der Fels-Klerx, H. J. (2015). Effect of Disinfectants on Preventing the Cross-Contamination of Pathogens in Fresh Produce Washing Water. *Int J Environ Res Public Health, 12*(8), 8658-8677. doi: http://dx.doi.org/10.3390/ijerph120808658

2. Zwietering, M. (2005). Practical considerations on food safety objectives. *Food Control, 16*(9), 817-823. doi: http://dx.doi.org/10.1016/j.foodcont.2004.10.022

FHM-064BM: How heat resistant are microorganisms?

Keywords:	meta-analysis, heat treatment experiments *D*- and *z*-value, variability
Supervisors:	Heidy den Besten (heidy.denbesten@wur.nl) Wilma Hazeleger Marcel Zwietering (marcel.zwietering@wur.nl)
Project duration:	MSc: 4–6 months; BSc: 4 months (4 months thesis includes no or limited lab work)
Specialisation:	MBT B, MFT A/E, MFS A/C

Project description

Numerous thermal inactivation studies have been done for foodborne pathogens and spoilage microorganisms to determine their thermal resistance. However, the results of the thermal inactivation studies vary because of the differences between used inactivation method, strain, inactivation medium, physiological state of the cells, etc. To determine the global thermal inactivation parameters of a pathogen, such as the *D*-value and *z*-value, a meta-analysis study can be initiated *(1)*. In a meta-analysis study, a vast number of thermal inactivation data of a foodborne pathogen are collected, and the global thermal inactivation parameters, as well as the factors influencing thermal resistance can be extracted. In this way, the differences found in many studies can be explained and the sources of variability can be listed and quantified. This information is critical to realistically predict inactivation of microorganisms in foods.

After the first meta-analysis initiative in 2006 for pathogens *(1)*, more and more thermal inactivation studies of foodborne pathogens have been published. Thus, there is a need to incorporate those recent publication data into the existing database, especially for the pathogens for which only few studies were available at that time. The extension of this database is expected to result in more reliable information on the thermal inactivation profile of the pathogen in question. Furthermore, we want to extend the data base with information on spoilage organisms.

Also you will perform heat inactivation experiments with several strains from a same species (e.g *Salmonella*, spores of *B. subtilis*) to compare strain variability to the variability found in literature *(2)*. This will help us to understand how strain variability affects thermal inactivation efficiency.

1. van Asselt, E. D., and M. H. Zwietering. 2006. A systematic approach to determine global thermal inactivation parameters for various food pathogens. *International Journal of Food Microbiology*. 107:73-82.

2. Aryani D.C., den Besten H.M.W., Hazeleger W.C., Zwietering M.H. 2015. Quantifying variability and the effect of growth history on thermal resistance of *Listeria monocytogenes*. *International Journal of Food Microbiology* 193, 130-138

FHM-065BM: What are the kinetics of toxin formation of *Bacillus cereus*?

Keywords:	meta-analysis, toxin production, variability
Supervisors:	Heidy den Besten (heidy.denbesten@wur.nl) Marcel Zwietering (marcel.zwietering@wur.nl)
Project duration:	MSc: 4 – 6 months; BSc: 4 months (4 months thesis includes no or limited lab work)
Specialisation:	MBT B, MFT A/E, MFS A/C

Project description

Numerous studies have been done to determine toxin production of *Bacillus cereus*. However, the results of these studies vary because of the differences between used method, strain, medium/food product, level, physiological state of the cells, etc. To determine the global kinetics of toxin production and main factors that control the formation, a meta-analysis study can be initiated *(1)*. In a meta-analysis study, a vast number of data are collected, and the global kinetic parameters, as well as the factors influencing this can be extracted. In this way, the differences found in many studies can partly be explained and the sources of variability can be listed and quantified. This information is critical to realistically get insight in toxin formation.
After the first meta-analysis initiative in 2006 for pathogens, more and more meta-analyses of foodborne pathogens have been published.

Also you will perform some experiments with several strains in media and in some food products to compare strain variability to the variability found in literature. This will help us to understand how strain variability affects toxin formation.

1. Heidy M.W. den Besten, Marcel H. Zwietering. 2012. Meta-analysis for quantitative microbiological risk assessments and benchmarking data. Trends in Food Science and Technology 25: 34-39

FHM-066BM: Milk spoilage at 0°C: what are main spoilers and their kinetics

Keywords:	meta-analysis, milk spoilage
Supervisors:	Marcel Zwietering (marcel.zwietering@wur.nl) Heidy den Besten (heidy.denbesten@wur.nl)
Project duration:	MSc: 4 – 6 months; BSc: 4 months (4 months thesis includes no or limited lab work)
Specialisation:	MBT B, MFT A/E, MFS A/C

Project description

Background:
Long duration milk transport in ships at 0°C needs insight in the main spoilers. If 250,000 liters of milk is pasteurized and then stored for weeks at low temperature, both the initial levels, survivors and growth rate at 0°C are of relevance.

Activities:

- Perform meta-analysis on the initial level, reduction during pasteurization and specific growth rate at 0°C (and T_{min}) of relevant psychrotolerant milk contaminants.
- Evaluate scenarios for spoilers and pathogens, such as *Pseudomonas*, *Listeria*, *Yersinia* for such transport.

1. https://patents.google.com/patent/WO2016204614A1/en

FHM-067B: Risk assessment of *Listeria monocytogenes*

Key words:	exposure assessment, risk assessment, maximum dose, competitive flora, ready-to-eat products
Supervisors:	Martine Reij (martine.reij@wur.nl)
Project duration:	BSc – 4 months (thesis includes no or limited lab work)

Project description:
Listeria monocytogenes has caused foodborne disease with major public health consequences, mainly in the elderly. The organism is known to grow in a variety of ready-to-eat products at refrigeration temperatures. Various authors have estimated the risk of listeriosis and the risk of ingesting a certain number of *Listeria* has been assumed to depend on time and refrigeration temperature; higher temperatures being associated with higher maximal doses and lower temperatures with lower maximal doses. The maximum number of organisms that can be reached forms an essential parameter in exposure assessment of *L. monocytogenes*.

Recent experimental research suggests that the maximal number of *L. monocytogenes* that can be present in ready-to-eat food products is higher than previously assumed. The objective of this research is to update existing risk assessment models with data on the maximum concentration of *L. monocytogenes*.