Bacterial community analysis for investigating bacterial transfer from tonsils to the pig carcass

Tonsils in the oral cavity are an important source of contamination during pig slaughter, but have not received as much attention as faecal contamination. In the present study, ten pigs were sampled from tonsils, faeces and three different areas on each carcass. The samples were analysed by both culturing of Escherichia coli and Yersinia enterocolitica and by 16S rRNA gene sequencing to characterize the bacterial communities. Comparing culture data from deep tonsil tissue and tonsil surface showed similar numbers of E. coli but significantly higher numbers of Y. enterocolitica in the deep tissue samples. Microbiota analysis showed similar bacterial communities in the two sample types at phylum level, while comparison at genus level showed significant differences between the relative abundance of several genera in the two sample types. The finding of a significantly higher relative abundance of Yersinia in tonsil tissue compared to tonsil surface supported the culture analysis. The microbiota analysis also investigated characteristics of the bacterial community that could discriminate bacterial transfer from tonsils and faeces to the carcass during slaughter. The microbiota analyses demonstrated that Fusobacteria and Proteobacteria are the most abundant phyla in tonsils, while Firmicutes showed the highest relative abundance in faeces. The dominating phylum on carcasses was Proteobacteria. Besides Proteobacteria, the swabbing area on the forepart of the carcass, showed a higher relative abundance of Firmicutes and Fusobacteria compared to swabbing areas on the rear part and mid-section of the carcass. Principal coordinate analysis showed clear clustering of samples based on sample source (tonsils, faeces and carcass). Carcass swab samples from the forepart tended to cluster closer to the tonsil samples compared to carcass swab samples from the rear part and mid-section.

Identification of the genera Fusobacterium, Moraxella, Actinobacillus and non-E. coli genera of the family Enterobacteriaceae in carcass swabs could indicate tonsil contamination, while faecal contamination would more likely include higher prevalence of bacteria belonging to the class of Clostridia. The present study supports that it is possible to identify bacterial groups that are indicative for either tonsil or faecal carcass contamination. The level and composition of Enterobacteriaceae on the carcasses did, however, indicate that other sources of meat contamination than tonsils and faeces may be important, such as the process environment.

Predicting the effect of salt on heat tolerance of Listeria monocytogenes in meat and fish products

General information
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Organisations: National Food Institute, Research group for Food Microbiology and Hygiene, Technical University of Denmark
Corresponding author: Hansen, T. B.
Contributors: Abdalas, S., Al-Hilali, I., Hansen, T. B.
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Publication date: 2019
Peer-reviewed: Yes
Event: Poster session presented at 11th International Conference on Predictive Modelling in Food , Braganza, Portugal.
Predicting the effect of salt on heat tolerance of Listeria monocytogenes in meat and fish products

General information
Publication status: Published
Organisations: National Food Institute, Research group for Food Microbiology and Hygiene, Technical University of Denmark
Corresponding author: Hansen, T. B.
Contributors: Abdalas, S., Al-Hilali, I., Hansen, T. B.
Pages: 78-78
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Editors: Gonzales-Barron, U., Cadavez, V. A. P.
ISBN (Print): 978-972-745-261-3
Keywords: Food safety, Heat treatment, Meat, Fish, Salt

Growth potential of pathogens in reverse osmosis filtrated whey intended for water re-use in cheese production

General information
Publication status: Published
Organisations: National Food Institute, Research group for Genomic Epidemiology, Division of Risk Assessment and Nutrition
Contributors: Hellmér, M., Buschhardt, T., Njage, P. M. K., Hansen, T. B., Aabo, S.
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Place of publication: Copenhagen, Denmark
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NOTAT: Anvendelse af Monte Carlo simulering til bestemmelse af effektkriterium for Listeria monocytogenes for varmebehandling af færdigretter

General information
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Organisations: National Food Institute, Research group for Food Microbiology and Hygiene
Contributors: Hansen, T. B.
Number of pages: 11
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Publication information
Place of publication: Kgs. Lyngby, Danmark
Publisher: Technical University of Denmark
NOTAT: Bestemmelse af effektkriterier for fødevarebårne sygdomsfremkaldende sporedannere ved varmebehandling af færdigretter

General information
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Organisations: National Food Institute, Research group for Food Microbiology and Hygiene
Contributors: Hansen, T. B.
Number of pages: 5
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Publication information
Place of publication: Kgs. Lyngby, Danmark
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Bibliographical note
Notat skrevet til FVST
Source: PublicationPreSubmission
Source ID: 161973341
Research output: Book/Report › Report – Annual report year: 2018 › Commissioned

TILLÆGSNOTAT: Anvendelse af Monte Carlo simulering til bestemmelse af effektkriterier for Clostridium perfringens og Bacillus cereus for varmholdelsen og nedkølingen af varmebehandlede færdigretter

General information
Publication status: Published
Organisations: National Food Institute, Research group for Food Microbiology and Hygiene
Contributors: Hansen, T. B.
Number of pages: 7
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Publication information
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A risk modelling approach for setting microbiological limits using enterococci as indicator for growth potential of Salmonella in pork

Microbiological limits are widely used in food processing as an aid to reduce the exposure to hazardous microorganisms for the consumers. However, in pork, the prevalence and concentrations of Salmonella are generally low and microbiological limits are not considered an efficient tool to support hygiene interventions. The objective of the present study was to develop an approach which could make it possible to define potential risk-based microbiological limits for an indicator, enterococci, in order to evaluate the risk from potential growth of Salmonella. A positive correlation between the concentration of enterococci and the prevalence and concentration of Salmonella was shown for 6640 pork samples taken at Danish cutting plants and retail butchers. The samples were collected in five different studies in 2001, 2002, 2010, 2011 and 2013. The observations that both Salmonella and enterococci are carried in the intestinal tract, contaminate pork by the same mechanisms and share similar growth characteristics (lag phase and maximum specific growth rate) at temperatures around 5-10 °C, suggest a potential of enterococci to be used as an indicator of potential growth of Salmonella in pork. Elevated temperatures during processing will lead to growth of both enterococci and, if present, also
Salmonella. By combining the correlation between enterococci and Salmonella with risk modelling, it is possible to predict the risk of salmonellosis based on the level of enterococci. The risk model used for this purpose includes the dose-response relationship for Salmonella and a reduction factor to account for preparation of the fresh pork. By use of the risk model, it was estimated that the majority of salmonellosis cases, caused by the consumption of pork in Denmark, is caused by the small fraction of pork products that has enterococci concentrations above 5 log. CFU/g. This illustrates that our approach can be used to evaluate the potential effect of different microbiological limits and therefore, the perspective of this novel approach is that it can be used for definition of a risk-based microbiological limit for enterococci. The limit for enterococci can then be used for development of a process hygiene criterion in cutting plants and retail butcher shops, with the purpose of reducing the risk of Salmonella for the consumer.

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Organisations: National Food Institute, Research Group for Microbial Food Safety, Research group for Risk Benefit
Contributors: Bollerslev, A. M., Nauta, M., Hansen, T. B., Aabo, S.
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Scopus rating (2017): CiteScore 3.76 SJR 1.366 SNIP 1.456
Web of Science (2017): Indexed yes
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Forudsigelse af opbevaringstemperatur til sikker lunholdelse af færdigretter

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Generic global regression models for growth prediction of Salmonella in ground pork and pork cuts

General information
Publication status: Published
Organisations: National Food Institute, Research Group for Microbial Food Safety, Research Group for Gut Microbiology and Immunology
Contributors: Buschhardt, T., Hansen, T. B., Bahl, M. I., Schaffner, D. W., Aabo, S.
Publication date: 2017
Media of output: PowerPoint

Event information
Generic global regression models for growth prediction of Salmonella in ground pork and pork cuts

Introduction and Objectives
Models for the prediction of bacterial growth in fresh pork are primarily developed using two-step regression (i.e. primary models followed by secondary models). These models are also generally based on experiments in liquids or ground meat and neglect surface growth. It has been shown that one-step global regressions can result in more accurate models and that bacterial growth on intact surfaces can substantially differ from growth in liquid culture.

Material and Methods
We used a global-regression approach to develop predictive models for the growth of Salmonella for three pork matrices: on the surface of shoulder (neck) and hind part (ham), and in ground pork. We conducted five experimental trials and inoculated essentially sterile pork pieces with a Salmonella cocktail (n = 192). Inoculated meat was aerobically incubated at 4 °C, 7 °C, 12 °C, and 16 °C for 96 h. One part of obtained logtransformed cell counts was used for model development and another for model validation. The Ratkowsky square root model and the relative lag time (RLT) model were integrated into the logistic model with delay. Fitted parameter estimates were compared to investigate the effect of meat structure on bacterial growth and goodness-of-fit was evaluated by root mean squared errors (RMSE). We used the Acceptable Simulation Zone (ASZ) approach and cross-validation with model-independent data to investigate if generic predictive models could accurately describe microbial growth across all studied pork products and compared our models to already existing generic models.

Results
Our results indicated that the growth of Salmonella was affected by product characteristics such as pH and structure, but storage temperature was shown to be the only variable needed to predict growth independent of pH and structural differences. RMSE of 0.54 suggested acceptable goodness-of-fit for the Salmonella generic growth model. Model evaluations of the generic growth model showed that described growth responses on pork neck and in ground pork were highly accurate with 86 and 98% of all model independent observations within the ASZ, respectively. Although growth descriptions showed less accuracy in the case of pork ham, a fail-safe model could still be developed. Model evaluation also showed that our model performed better than generic existing models.

Conclusions
We suggested that generic model with fewer variables might provide a more suitable approach to bacterial growth modeling in fresh pork if pH and the type of pork product are unknown. Our study provides a “ready-to-use” global regression model relevant for a wide range of time and temperature combinations and various fresh pork products. The model should be a useful tool to control growth of Salmonella in meat and set critical limits for temperature during production and storage of fresh pork.

Growth parameter estimates of listeria monocytogenes in cooked chicken: Effect of preparation of inoculum

General information
Publication status: Published
Organisations: National Food Institute, Research Group for Microbial Food Safety, Research Group for Gut Microbiology and Immunology
Contributors: Buschhardt, T., Hansen, T. B., Bahl, M. I., Schaffner, D. W., Aabo, S.
Number of pages: 1
Publication date: 2017

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Research output: Chapter in Book/Report/Conference proceeding › Conference abstract in proceedings – Annual report year: 2017 › Research › peer-review

Growth parameter estimates of listeria monocytogenes in cooked chicken: Effect of preparation of inoculum

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Growth parameter estimates of Listeria monocytogenes in cooked chicken: effect of preparation of inoculum

General information
Publication status: Published
Organisations: National Food Institute, Research Group for Microbial Food Safety, University College Zealand
Contributors: Birk, T., Smith Ottosen, S., Hansen, T. B.
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Peer-reviewed: Yes
Event: Poster session presented at 10th International Conference on Predictive Modelling in Food, Cordoba, Spain.
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Source ID: 140541315
Research output: Contribution to conference › Poster – Annual report year: 2017 › Research › peer-review
Microbiota analysis to reveal temperature abuse of fresh pork

Violations of temperature regulations in the meat chain may affect meat safety. Methods are lacking to estimate whether meat has been subjected to temperature abuse. Exposure to too high temperatures may lead to systematic changes in the diverse bacterial communities of fresh meat. We investigated whether temperature induced changes in the community composition on fresh meat surfaces can reflect the temperature-history (combination of time and temperature). Sterile pieces of pork were inoculated with a carcass swab homogenate, to which Salmonella was added. Changes in the meat microbiota were monitored during aerobic chill-storage (4 °C and 7 °C) and temperature abuse (12 °C and 16 °C) for 96 hours, by culture-based methods and 16S rRNA gene sequencing. Bacterial genera that dominated during prolonged temperature abuse were Acinetobacter, Serratia and Pseudomonas, whereas chill-stored meat was dominated by Pseudomonas only. We also showed that the initial community affects subsequent changes during storage. The results suggest that principal coordinate analysis of beta diversity could be a useful tool to reveal temperature abused meat. Sequence data and culturing data revealed a strong positive association between growth of Escherichia coli and growth of Salmonella, which suggests that Escherichia coli can be used as indicator of temperature-history supporting growth of Salmonella on fresh pork surfaces.

General information
Publication status: Published
Organisations: National Food Institute, Research Group for Microbial Food Safety, Research Group for Gut Microbiology and Immunology, University of Copenhagen
Contributors: Buschhardt, T., Bahl, M. I., Hansen, T. B., Brejnrod, A. D., Abu Al-Soud, W., Mortensen, M. S., Sørensen, S. J., Aabo, S.
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Source ID: 140503909
Research output: Contribution to conference › Poster – Annual report year: 2017 › Research › peer-review
Microbiota analysis to reveal temperature abuse of fresh pork

Violations of temperature regulations in the meat chain may affect meat safety. Methods are lacking to estimate whether meat has been subjected to temperature abuse. Exposure to too high temperatures may lead to systematic changes in the diverse bacterial communities of fresh meat. We investigated whether temperature induced changes in the community composition on fresh meat surfaces can reflect the temperature-history (combination of time and temperature). Sterile pieces of pork were inoculated with a carcass swab homogenate, to which Salmonella was added. Changes in the meat microbiota were monitored during aerobic chill-storage (4 °C and 7 °C) and temperature abuse (12 °C and 16 °C) for 96 hours, by culture-based methods and 16S rRNA gene sequencing. Bacterial genera that dominated during prolonged temperature abuse were Acinetobacter, Serratia and Pseudomonas, whereas chill-stored meat was dominated by Pseudomonas only. We also showed that the initial community affects subsequent changes during storage. The results suggest that principal coordinate analysis of beta diversity could be a useful tool to reveal temperature abused meat. Sequence data and culturing data revealed a strong positive association between growth of Escherichia coli and growth of Salmonella, which suggests that Escherichia coli can be used as indicator of temperature-history supporting growth of Salmonella on fresh pork surfaces.

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Organisations: National Food Institute, Research Group for Microbial Food Safety, Research Group for Gut Microbiology and Immunology, Al Jouf University, University of Copenhagen
Contributors: Buschhardt, T., Bahl, M. I., Hansen, T. B., Brejnrod, A. D., Abu Al-Soud, W., Mortensen, M. S., Sørensen, S. J., Aabo, S.
Pages: 49-49
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Modelling Salmonella transfer during grinding of meat

General information
Publication status: Published
Organisations: National Food Institute, Research Group for Microbial Food Safety
Contributors: Hansen, T. B.
Publication date: 2017
Media of output: PowerPoint

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Event: MeatCrossCon 2017
Location: National Food Institute, DTU Building 202 Kemitorvet 2800 Lyngby, Kgs. Lyngby, Denmark
Electronic versions:
slutseminar_tibha_070917.pdf
Source: PublicationPreSubmission
Source ID: 136921733
Research output: Non-textual form › 2D/3D (physical products) – Annual report year: 2017 › Research

NOTAT: Anvendelse af Monte Carlo simulering til bestemmelse af effektkriterium for Clostridium perfringens og Bacillus cereus for nedkølingen af varmebehandlade færdigretter

General information
Publication status: Published
Organisations: National Food Institute, Research Group for Microbial Food Safety
Contributors: Hansen, T. B., Møller, C. O. D. A.
Number of pages: 6
Publication date: 2017

Publication information
A risk-based approach for evaluation of hygiene performance at pig slaughter

In Denmark, the pig slaughterhouses have a daily input of pigs infected and/or contaminated with Salmonella, and the slaughter hygiene has major influence on the level of Salmonella contamination on the meat leaving the slaughterhouse. However, the relationship between the effect of improved hygiene performance and the consequential reduction of human health risk has not been estimated so far. In this study, swab samples from 2702 pig carcasses were collected, originally for other purposes, from five large Danish slaughterhouses in a period from 2005 to 2007, covering all seasons of the year. The samples were analysed quantitatively for E. coli and semi-quantitatively for Salmonella. A positive association between the number of E. coli on carcasses and the prevalence of Salmonella positive carcasses was shown. For carcasses positive for Salmonella, a positive association was also shown between the number of E. coli and the number of Salmonella on the carcass. As no biological association has been reported between faecal shedding of E. coli and presence of Salmonella, the relationship was considered to be associated with the level of faecal contamination. The positive association between E. coli and Salmonella was used as basis for developing a quantitative risk assessment model for Salmonella, using the level E. coli as model input. The model output associated the hygiene performance with a relative risk estimate of human salmonellosis. The overall objective was to develop a decision support tool that can be used to support risk-based hygiene interventions in pig slaughterhouses.
ConFerm - A tool to predict the reduction of pathogens during the production of fermented and matured sausages

Existing growth models and non-thermal survival models for Salmonella, Shiga-toxin producing Eschericia coli (STEC) and Listeria monocytogenes primarily focus on the static effect of a(w), sodium nitrite (NaNO2), pH and temperature. However, during the production of fermented sausages, the intrinsic factors and temperature change, and there is a need to develop models that can predict pathogen survival under dynamic conditions. The objective of this study was to develop a novel mathematical model for predicting survival of Salmonella, STEC and L. monocytogenes, taking into account the dynamics of the sausage environment during fermentation and maturation of fermented sausages. A total of 73 experiments were carried out in sausages containing different levels of NaCl in the water phase (WPS) (3.9-6.8%), NaNO2 (0-200 ppm) and pH(48h) (4.3-5.6). The minced meat was inoculated with approx. 10^6 cfu/g of a multi-strain cocktail of 3 strains of Salmonella (S. Dublin, S. Typhimurium, S. Derby), 3 strains of STEC (O26:H-, O111:H- and O157) and five L. monocytogenes strains isolated from different meat products and environment. The sausages were fermented at 24 degrees C for 48 h using three different commercially available starter cultures followed by maturation at 16 degrees C until a weight loss of between 15% and 35% was achieved. Enumeration of Salmonella, STEC and L. monocytogenes was performed up to six times during fermentation and maturation, allowing for calculation of the logio reductions at each time point. The microbiological data, together with data for NaNO2 and changes in pH and WPS, were used to develop the "ConFerm" tool, which consists of three separate partial least squares regression (PLS) models for predicting the reduction of Salmonella, STEC and L. monocytogenes, respectively, as a function of weight loss, pH decrease, NaNO2 and WPS. The "ConFerm" tool was validated on a separate data set (n = 19). The Salmonella model had bias and accuracy factors of 1.02 and 1.15, the STEC model 1.04 and 1.24 and the L. monocytogenes model 0.99 and 1.27, respectively, indicating highly acceptable models. In conclusion, the models are applicable for predicting reduction of Salmonella, STEC and L. monocytogenes during the production of fermented sausages fermented at 24 degrees C and matured at 16 degrees C. The model has been made available to producers and other interested parties at http://dmripredict.dk (in English). (C) 2016 Elsevier Ltd. All rights reserved.
Enterococci as indicator of potential growth of Salmonella in fresh minced meat at retail

The present study had the purpose of demonstrating a positive correlation between enterococci and Salmonella in minced pork and beef. Data from 2001 to 2002 from retail minced pork and beef in Denmark were used and the association between concentration of enterococci and prevalence and concentration of Salmonella was examined. A total of 2187 and 2747 samples of minced pork and beef, respectively, were collected from butcher shops and supermarkets throughout the country. In pork, 2.1% of all samples were positive for Salmonella whereas 1.5% of beef samples were positive. Among samples with ≥100 CFU/g of enterococci, prevalence of Salmonella positive samples was 3.4%, which was significantly higher than 1.2% observed in minced meat with less than 100 CFU/g of enterococci (P <0.001). A positive association between occurrence of enterococci and presence of Salmonella in retail minced meat was supported as both prevalence and concentration of Salmonella in positive samples increased with increasing concentrations of enterococci in minced meat. From our data, we suggest that minced meat containing more than 500 enterococci per gram is suspected of having been exposed to temperatures allowing growth of Salmonella. This is to our knowledge the first report, which links presence of an indicator to potential growth of Salmonella.

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Web of Science (2016): Impact factor 3.759
Web of Science (2016): Indexed yes
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Source: FindIt
Source ID: 2304565838
Research output: Contribution to journal › Journal article – Annual report year: 2016 › Research › peer-review
Growth potential of exponential- and stationary-phase Salmonella Typhimurium during sausage fermentation

Raw meat for sausage production can be contaminated with Salmonella. For technical reasons, meat is often frozen prior to mincing but it is unknown how growth of Salmonella in meat prior to freezing affects its growth potential during sausage fermentation. We investigated survival of exponential- and stationary-phase Salmonella Typhimurium (DT12 and DTU292) during freezing at −18 °C and their subsequent growth potential during 72 h sausage fermentation at 25 °C. After 0, 7 and >35 d of frozen storage, sausage batters were prepared with NaCl (3%) and NaNO2 (0, 100 ppm) and fermented with and without starter culture. With no starter culture, both strains grew in both growth phases. In general, a functional starter culture abolished S. Typhimurium growth independent of growth phase and we concluded that ensuring correct fermentation is important for sausage safety. However, despite efficient fermentation, sporadic growth of exponential-phase cells of S. Typhimurium was observed drawing attention to the handling and storage of sausage meat.
Predicting outgrowth and inactivation of Clostridium perfringens in meat products during low temperature long time heat treatment

With low temperature long time (LTLT) cooking it can take hours for meat to reach a final core temperature above 53 °C and germination followed by growth of Clostridium perfringens is a concern. Available and new growth data in meats including 154 lag times (t_{lag}), 224 maximum specific growth rates (\mu_{max}) and 25 maximum population densities (N_{max}) were used to developed a model to predict growth of C. perfringens during the coming-up time of LTLT cooking. New data were generate in 26 challenge tests with chicken (pH 6.8) and pork (pH 5.6) at two different slowly increasing temperature
(SIT) profiles (10 °C to 53 °C) followed by 53 °C in up to 30 h in total. Three inoculum types were studied including vegetative cells, non-heated spores and heat activated (75 °C, 20 min) spores of C. perfringens strain 790-94. Concentrations of vegetative cells in chicken increased 2 to 3 log CFU/g during the SIT profiles. Similar results were found for non-heated and heated spores in chicken, whereas in pork C. perfringens 790-94 increased less than 1 log CFU/g. At 53 °C C. perfringens 790-94 was log-linearly inactivated. Observed and predicted concentrations of C. perfringens, at the time when 53 °C (log(N53)) was reached, were used to evaluate the new growth model and three available predictive models previously published for C. perfringens growth during cooling rather than during SIT profiles. Model performance was evaluated by using mean deviation (MD), mean absolute deviation (MAD) and the acceptable simulation zone (ASZ) approach with a zone of ± 0.5 log CFU/g. The new model showed best performance with MD = 0.27 log CFU/g, MAD = 0.66 log CFU/g and ASZ = 67%. The two growth models that performed best, were used together with a log-linear inactivation model and D53-values from the present study to simulate the behaviour of C. perfringens under the fast and slow SIT profiles investigated in the present study. Observed and predicted concentrations were compared using a new fail-safe acceptable zone (FSAZ) method. FSAZ was defined as the predicted concentration of C. perfringens plus 0.5 log CFU/g. If at least 85% of the observed log-counts were below the FSAZ, the model was considered fail-safe. The two models showed similar performance but none of them performed satisfactorily for all conditions. It is recommended to use the models without a lag phase until more precise lag time models become available.

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Publication status: Published
Organisations: National Food Institute, Research Group for Microbial Food Safety and Quality, Research Group for Diagnostic Engineering, University of Copenhagen
Contributors: Duan, Z., Hansen, T. H., Hansen, T. B., Dalgaard, P., Knøchel, S.
Number of pages: 13
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Web of Science (2016): Indexed yes
Original language: English
Keywords: Fail-safe acceptable zone (FSAZ) approach, Low temperature cooking, Slowly increasing temperature (SIT), Food Science, Microbiology, Safety, Risk, Reliability and Quality, absorption lag time, animal experiment, bacterial spore, behavior, chicken, Clostridium perfringens, cooking, cooling, growth rate, heat treatment, inoculation, loglinear model, low temperature, meat, nonhuman, population density, pork, provocation test
DOIs: 10.1016/j.ijfoodmicro.2016.03.019
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Source ID: 2303382201
Research output: Contribution to journal › Journal article – Annual report year: 2016 › Research › peer-review

Predictive food microbiology

General information
Publication status: Published
Organisations: National Food Institute, Research Group for Microbial Food Safety and Quality
Contributors: Hansen, T. B.
Publication date: 2016
Media of output: PowerPoint

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predictive_micro_041215_Tina_Beck.pdf
Research output: Non-textual form › Sound/Visual production (digital) – Annual report year: 2016 › Education
Robustness of a cross contamination model describing transfer of pathogens during grinding of meat
This study aimed to evaluate a cross contamination model for its capability of describing transfer of Salmonella spp. and L. monocytogenes during grinding of varying sizes and numbers of pieces of meats in two grinder systems. Data from 19 trials were collected. Three evaluation approaches were applied: i) Acceptable Simulation Zone method compared observed with simulated transfer, ii) each trial was fitted and parameters were integrated in a Quantitative Microbiological Risk Assessment model, iii) the Total Transfer Potential was calculated from fitted parameters. Risk estimates revealed that grinding was influenced by sharpness of grinder knife, specific grinder and grinding temperature.

General information
Publication status: Published
Organisations: National Food Institute, Research group for Risk Benefit, Research Group for Microbial Food Safety, Universidade de Sao Paulo, University of Campinas
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Sikker fremstilling af fermenterede pølser

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Organisations: National Food Institute, Research Group for Microbial Food Safety
Contributors: Hansen, T. B.
Publication date: 2016
Media of output: PowerPoint

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fermentering_tibha_241016.pdf
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Source ID: 126768955
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Varmetolerance

General information
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Organisations: National Food Institute, Research Group for Microbial Food Safety and Quality
Contributors: Hansen, T. B.
Publication date: 2016
Media of output: PowerPoint

Event information
Event: Specialiseringskursus Listeria - Specialiserings-og aktualitetskursus for erfarne tilsynsførende i Fødevarestyrelsen
Location: Glostrup, Denmark
Electronic versions:
Varmetolerance>Listeria_270116.pdf
16S rRNA gene sequencing as a tool to study microbial populations in foods and process environments: limitations and opportunities

Introduction: Methodological constraints during culturing and biochemical testing have left the true microbiological diversity of foods and process environments unexplored. Culture-independent molecular methods, such as 16S rRNA gene sequencing, may provide deeper insight into microbial communities and their role in food safety. During method optimization, we have identified several factors which distort the characterization of microbial populations, including DNA extraction methods, DNA polymerases, and most importantly the analyzed fragment of the 16S rRNA gene.

Methods: This study investigated microbial communities in meat and the meat process environment with special focus on the Enterobacteriaceae family as a subpopulation comprising enteropathogens including Salmonella. Samples were analyzed by a nested PCR approach combined with MiSeq® Illumina®16S DNA sequencing and standardized culture methods as cross reference.

Results: Taxonomic assignments and abundances of sequences in the total community and in the Enterobacteriaceae subpopulation were affected by the 16S rRNA gene variable region, DNA extraction methods, and polymerases chosen. However, community compositions were very reproducible when the same methods were used.

Conclusions: Altogether, we have shown that conclusions from population studies based on 16S rRNA gene sequencing need to be made with caution. Overcoming the constraints, we believe that population studies can give new research possibilities for e.g. interaction studies, identification and growth of indicator organisms, or source attribution.
A risk modelling approach for setting microbiological criteria: using enterococci as indicator for Salmonella in pork

General information
Publication status: Published
Organisations: National Food Institute, Research Group for Microbial Food Safety and Quality, Research group for Risk Benefit
Contributors: Bollerslev, A. M., Hansen, T. B., Nauta, M., Aabo, S.
Publication date: 2015
Media of output: PowerPoint

Event information
Event: 9th International Conference on Predictive Modelling in Food
Location: Rio de Janeiro, Brazil
Electronic versions:
O11.01_Bollerslev.pdf
Source: PublicationPreSubmission
Source ID: 118981730
Research output: Non-textual form › Sound/Visual production (digital) – Annual report year: 2015 › Research

A risk modelling approach for setting process hygiene criteria for Salmonella in pork cutting plants, based on enterococci. Pork is known to be a key source of foodborne salmonellosis. Processing steps from slaughter to cutting and retail contribute to the Salmonella consumer exposure. In two extensive surveys comprising a total of 5,310 pork samples, cuttings and minced meat were analysed semiquantitatively for Salmonella and quantitatively for the hygiene indicator enterococci. The samples were collected in 2001/2002 and 2010/2011 in Danish cutting plants, retail supermarkets and butcher shops. A positive correlation between prevalence of Salmonella and number of enterococci was shown (Hansen et al., 2013). As enterococci and Salmonella share a lower growth limit around 5°C, the positive correlation could imply that the meat had been exposed to temperatures above 5°C. Based on these findings, the objective of this study was to develop an approach for setting process hygiene criteria for predicting Salmonella risk in cutting plants from enterococci counts. The novel approach uses risk modelling to associate a relative consumer risk to different levels of enterococci in pork. The applied risk model was a modification of a model developed by Duarte et al. (submitted). The output is an estimate of the relative risk of acquiring salmonellosis associated to a given concentration of Salmonella. The relative risk of acquiring salmonellosis was then associated to the concentration of enterococci by using the observed positive correlation between Salmonella and enterococci as model input. From the applied model it was deduced how much the consumer risk can be reduced if enterococci is kept below a certain limit.

General information
Publication status: Published
Organisations: National Food Institute, Research Group for Microbial Food Safety and Quality, Research group for Risk Benefit
Contributors: Bollerslev, A. M., Hansen, T. B., Nauta, M., Aabo, S.
Number of pages: 1
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Place of publication: Rio de Janeiro, Brazil
Article number: O11.01
Keywords: Process hygiene criteria, Risk modelling, Salmonella, Pork meat
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Research output: Chapter in Book/Report/Conference proceeding › Conference abstract in proceedings – Annual report year: 2015 › Research › peer-review

Bakteriologisk fødevaresikkerhed i bagerier

General information
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Organisations: National Food Institute, Division of Food Microbiology
Contributors: Hansen, T. B.
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Media of output: PowerPoint
Electronic versions:
Glostrup_slides_211114.pdf
Evaluation of a cross contamination model describing transfer of salmonella spp. and listeria monocytogenes during grinding of pork and beef

Introduction: The cross contamination model (Møller et al. 2012) was evaluated to investigate its capability of describing transfer of Salmonella spp. and Listeria monocytogenes during grinding of pork and beef of varying sizes (50 – 324 g) and numbers of pieces to be ground (10 – 100), in two grinder systems. Methods: Data from 19 trials were collected. Three different evaluation approaches were applied: i) an Acceptable Simulation Zone (ASZ) method compared observed with simulated transfer from the proposed model, ii) each trial was fitted and its respective parameter estimates were integrated in a Quantitative Microbiological Risk Assessment (QMRA) model (Møller et al. 2015), and iii) the Total Transfer Potential (TTP) was calculated for each of the 20 fitted parameter estimates. Results: The ASZ showed that the Møller et al. (2012) model could only describe seven of the 19 trials to an acceptable extent. However, all transfer curves could be fitted to the model structure proposed by Møller et al. (2015). A positive correlation was found between QMRA risk estimates and TTP for the individual trials. Conclusions: Results indicated that transfer estimates were not applicable for unlike processing. QMRA risk estimates and TTP both revealed that risk attribution from grinding was mainly influenced by sharpness of grinder knife > specific grinder > grinding temperature whereas the specific pathogen was of minor importance.

General information
Publication status: Published
Organisations: National Food Institute, Research Group for Microbial Food Safety and Quality, Research group for Risk Benefit, University of Campinas
Contributors: Møller, C. O. D. A., Hansen, T. B., Aabo, S., Nauta, M., Sant’Ana, A. S.
Pages: 79-79
Publication date: 2015

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Title of host publication: The Danish Microbiological Society Annual Congress 2015 : Programme & Abstracts
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HACCP and its role in EU Food Legislation

General information
Publication status: Published
Organisations: Division of Food Microbiology, National Food Institute, Research Group for Microbial Food Safety and Quality
Contributors: Hansen, T. B.
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Prædiktiv mikrobiologi
General information
Publication status: Published
Organisations: Division of Food Microbiology, National Food Institute, Research Group for Microbial Food Safety and Quality
Contributors: Hansen, T. B.
Publication date: 2015
Media of output: PowerPoint
Electronic versions:
predictive_mikro_280415_Tina_Beck.pdf
Research output: Non-textual form › Sound/Visual production (digital) – Annual report year: 2015 › Education

Predicting safe sandwich production

General information
Publication status: Published
Organisations: National Food Institute, Research Group for Microbial Food Safety and Quality, Division of Industrial Food Research, University of Copenhagen
Contributors: Birk, T., Duan, Z., Møller, C. O. D. A., Friis Hansen, H., Knøchel, S., Hansen, T. B.
Number of pages: 1
Publication date: 2015
Peer-reviewed: Yes
Event: Poster session presented at 9th International Conference on Predictive Modelling in Food, Rio de Janeiro, Brazil.
Electronic versions:
sikker_sandwich_poster_engelsk_281014.pdf
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Predicting safe sandwich production: P. 017

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Publication status: Published
Organisations: National Food Institute, Research Group for Microbial Food Safety and Quality, Division of Industrial Food Research, University of Copenhagen
Contributors: Birk, T., Duan, Z., Møller, C. O. D. A., Hansen, H. F., Knøchel, S., Hansen, T. B.
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Publication date: 2015
Peer-reviewed: Yes
Event: Abstract from 9th International Conference on Predictive Modelling in Food, Rio de Janeiro, Brazil.
Keywords: Listeria monocytogenes, Salmonella, Clost ridium botulinum, Relative lag time
Electronic versions:
abstracts_681251_.pdf
Source: PublicationPreSubmission
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Risk assessment of Salmonella in Danish meatballs produced in the catering sector

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Publication status: Published
Organisations: National Food Institute, Research Group for Microbial Food Safety and Quality, Research group for Risk Benefit, Rutgers University
Contributors: Møller, C. O. D. A., Nauta, M., Schaffner, D. W., Dalgaard, P., Christensen, B. B., Hansen, T. B.
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Event information
Event: Workshop on QMRA applied to food
Location: Federal University of Rio Grande do Sul, Porto Alegre, Brazil
Electronic versions:
Cleides_QMRA_28ago2015.pdf
Research output: Non-textual form › Sound/Visual production (digital) – Annual report year: 2015 › Research
Risk assessment of Salmonella in Danish meatballs produced in the catering sector
A modular process risk model approach was used to assess health risks associated with Salmonella spp. after consumption of the Danish meatball product ( frikadeller) produced with fresh pork in a catering unit. Meatball production and consumption were described as a series of processes (modules), starting from 1.3 kg meat pieces through conversion to 70 g meatballs, followed by a dose response model to assess the risk of illness from consumption of these meatballs. Changes in bacterial prevalence, concentration, and unit size were modelled within each module. The risk assessment was built using observational data and models that were specific for Salmonella spp. in meatballs produced in the catering sector. Danish meatballs are often pan-fried followed by baking in an oven before consumption, in order to reach the core temperature of 75 degrees C recommended by the Danish Food Safety Authority. However, in practice this terminal heat treatment in the oven may be accidentally omitted. Eleven production scenarios were evaluated with the model, to test the impact of heat treatments and cooling rates at different room temperatures. The risk estimates revealed that a process comprising heat treatment of meatballs to core temperatures higher than 70 degrees C, and subsequent holding at room temperatures lower than 20 degrees C, for no longer than 3.5 h, were very effective in Salmonella control. The current Danish Food Safety Authority recommendation of cooking to an internal temperature of 75 degrees C is conservative, at least with respect to Salmonella risk. Survival and growth of Salmonella during cooling of meatballs not heat treated in oven had a significant impact on the risk estimates, and therefore, cooling should be considered a critical step during meatball processing. (c) 2014 Published by Elsevier B.V.
Salmonella Dublin i oksekød, 2014

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Publication status: Published
Organisations: National Food Institute, Research Group for Microbial Food Safety and Quality
Contributors: Aabo, S., Hansen, T. B.
Number of pages: 8
Publication date: 2015

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Place of publication: Søborg
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Original language: Danish
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29.11.2015_Rapport_Salmonella_Dublin_oksek_d_2014__..pdf
Source: PublicationPreSubmission
Source ID: 119523799
Research output: Book/Report › Report – Annual report year: 2015 › Commissioned

Saltning

General information
Publication status: Published
Organisations: National Food Institute, Research Group for Microbial Food Safety
Contributors: Hansen, T. B.
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saltning_031115.pdf

Bibliographical note
FVST kødspecialiseringskursus
Number of pages: 18
Source: PublicationPreSubmission
Source ID: 134548430
Research output: Non-textual form › Sound/Visual production (digital) – Annual report year: 2015 › Commissioned

Udvikling af proceshygiejnekriterier i fersk køds opskæringen

General information
Publication status: Published
Organisations: National Food Institute, Research Group for Microbial Food Safety and Quality, Research group for Risk Benefit, Danish Veterinary and Food Administration
Publication date: 2015

Event information
Event: Strategidag mellem FVST og DTU 2015
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Research output: Non-textual form › Sound/Visual production (digital) – Annual report year: 2015 › Commissioned

Varmebehandling
Analysis of dynamic changes in the meat microbiota during varied temperature exposures - a novel method to estimate temperature history and pathogen growth in meat

Buffer capacity of food components influences the acid tolerance response in Salmonella Typhimurium during simulated gastric passage

Buffer capacity of food components influences the acid tolerance response in Salmonella Typhimurium during simulated gastric passage

Food composition, buffer capacity, and fat and protein content have been shown to effect the gastric acid survival of pathogens (Waterman & Small 1998). In this study, simple food-model substances with different buffer capacities were investigated for their ability to support survival of stationary phase Salmonella Typhimurium during simulated gastric acid passage. We used a computer-controlled fermentor to employ pH changes in synthetic gastric fluid, mimicking the dynamic pH during gastric passage. In order to minimise variation, Salmonella enterica serovar Typhimurium was contained in dialysis tubes, enabling simultaneous testing of biological triplicates under varying conditions. Surprisingly, we found that less buffered media provided higher protection of Salmonella, compared to media with high buffer capacity. By investigating the relative gene expression of rpoS and ompR encoding for two major stationary phase ATR regulators, we found an approx. four-fold increase in expression of ompR and an approx. three-fold increase of rpoS in saline and buffered saline, respectively, after 15 min of gastric acid challenge. The relative expression of these genes, were significantly lower in Brain Heart Infusion Broth having a higher buffer capacity. We suggest this to be associated with a varying ability of Salmonella Typhimurium to mount a stationary phase acid tolerance response (ATR) depending on the buffer capacity of the food vehicle.
Buffer capacity of food components influences the acid tolerance response in Salmonella Typhimurium during simulated gastric passage

General information
Publication status: Published
Organisations: National Food Institute, Division of Food Microbiology
Contributors: Aabo, S., Buschhardt, T., Hansen, T. B., Birk, T., Henriksen, S.
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Peer-reviewed: Yes
Event: Poster session presented at The Danish Microbiological Society Annual Congress 2014, Copenhagen, Denmark.
Electronic versions: Buffer_capacity_poster.pdf
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Forudsigelse af opbevaringstemperatur ved lunholdelse af færdigretter

General information
Publication status: Published
Organisations: National Food Institute, Division of Food Microbiology, Division of Industrial Food Research
Contributors: Hansen, T. B., Hansen, S. K. H.
Publication date: 2014
Media of output: PowerPoint
Event information
Event: Temadag "Prædiktiv mikrobiologi - et centralt redskab til produktudvikling og dokumentation af fødevaresikkerhed"
Location: DTU, Lyngby, Denmark
Electronic versions: Forudsigelse_af.pdf
Research output: Non-textual form › Sound/Visual production (digital) – Annual report year: 2015 › Research

Patogener og hygiejneparametre i kød fra opskæringsvirksomheder: Opgørelse af opskæringsprojekt 2011-20-64-00336

General information
Publication status: Published
Organisations: National Food Institute, Division of Food Microbiology
Contributors: Birk, T., Hansen, T. B., Aabo, S.
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Publication information
Publisher: DTU Fødevareinstituttet
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Predicting safe sandwich production

General information
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Organisations: National Food Institute, Division of Food Microbiology, Division of Industrial Food Research
Contributors: Birk, T., Duan, Z., Møller, C. O. D. A., Hansen, T. B., Friis Hansen, H., Knehel, S.
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Event: Poster session presented at The Danish Microbiological Society Annual Congress 2014, Copenhagen, Denmark.
Predicting safe sandwich production

Time and temperature control is crucial to avoid growth of pathogens during production and serving of cold ready-to-eat meals. The Danish guidelines state that chilled foods, such as sandwiches, should not be outside the cold chain for more than 3 hours including the time for preparation and serving. However, Danish sandwich producing companies find it challenging to comply with this and have expressed a need for more flexibility. The Danish guidelines do allow for a prolongation of the acceptable time outside the cold chain, if the safety of the specific production can be documented. There is, therefore, room for developing targeted tools for evaluating the time-temperature scenarios in sandwich production. This study describes a decision support tool developed to offer the producers more flexibility. Based on time/temperature measurements obtained during preparation combined with information on the prehistory of ingredients and the expected time/temperature conditions of distribution and serving, the potential growth of Listeria monocytogenes, Salmonella and psychrotrophic Clostridium botulinum in the sandwiches is predicted. Applying the lag times of these pathogens as the critical limit, the tool determines if the sandwich production is safe by evaluating whether any of the lag times have been exceeded during the total preparation, distribution, and serving time. The growth models employed were built as part of the study using a “worst case” ingredient.
Risikovurdering af letfordærveligt fyld til sandwich og pizza med fokus på hvor lang tid det kan opbevares uden for køl

**General information**
Publication status: Published
Organisations: National Food Institute, Division of Food Microbiology
Contributors: Hansen, T. B., Andersen, J. K.
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Bibliographical note

Risikovurdering af varmebehandlede produkter der lunholdes ved temperaturer i niveauet 65°C til 20°C i 3 timer

**General information**
Publication status: Published
Organisations: National Food Institute, Division of Food Microbiology
Contributors: Hansen, T. B.
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Risikovurdering angående genopvarmning af fødevarer efter "utilstrækkelig" nedkøling

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Publication status: Published
Organisations: National Food Institute, Division of Food Microbiology
Contributors: Hansen, T. B.
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Salmonella og hygiejneparametre i opskæringsvirksomheder

**General information**
**Saltning**

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Contributors: Hansen, T. B.  
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Organisations: National Food Institute, Division of Food Microbiology  
Contributors: Hansen, T. B.  
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Contributors: Hansen, T. B.  
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Electronic versions:  
sikker_opvarm_poster.pdf  
Bibliographical note  
poster præsenteret ved  
Temadag "Prædiktiv mikrobiologi - et centralet redskab til produktudvikling og dokumentation af fødevaresikkerhed" den 27/02/2014 på DTU, Lyngby  
Source: dtu  
Source ID: u::10785
Combining predictive microbiology with cold-enrichment in minced pork for quantifying low levels of Salmonella Typhimurium DT104

OBJECTIVE
For determination of Salmonella concentration in meat various methods can be used depending on the expected level. When higher levels (102 to 103 bacteria or more per g) are anticipated, plate count techniques using selective agars, i.e. XLD, are appropriate whereas for low numbers (3 to 102 bacteria per g) a most probable number (MPN) method is recommended. Recently, a real-time PCR-based tool for determination of concentrations as low as 1.4 Salmonella per 20 cm (approx. 10 g) of cork-borer samples of pig carcasses has been developed (Krämer et al. 2011). However, compared to plate count techniques the MPN and real-time PCR methods are very labour intensive and might not be suitable when analysing many samples within a short timeframe. We suggest to use enrichment in the meat itself and use the two species interaction model, presented by Møller et al. (2013), for quantifying levels of Salmonella Typhimurium DT104 in minced pork.

METHODS
A total number of 101 minced pork samples were inoculated artificially with various concentrations (from 10 to 106 bacteria per g) of stationary phase S. Typhimurium DT104. Counts of S. Typhimurium DT104 as well as natural microbiota in the samples were determined immediately after inoculation and again after an enrichment step in the minced meat for approx. 48 h at 11 – 16°C. A rearranged version of the expanded Jameson-effect species interaction model, suggested by Møller et al. (2013), was applied for prediction of the Salmonella concentration in the minced pork samples. Observed and predicted counts of S. Typhimurium DT104 (log10-units) prior to enrichment were compared visually and by the acceptable prediction zone (APZ) method, i.e. percentage of predictions being within ±0.5 log10-units of observed values.

RESULTS
A relatively good agreement between predicted and observed values was seen. However, only 56 % of the predictions were within the APZ. The model tended to over-predict counts from 3 log-units and above, whereas under-prediction to some extent was seen for counts below 3 log10-units. Over-prediction was most likely explained by uncertainty of the lag-time model for Salmonella, i.e. a short lag time would result in a lower initial count to get to the same count after enrichment as compared to a long lag time. In contrast, part of the under-prediction appeared to coincide with competitive growth of Citrobacter braakii and Hafnia alvei on the selective agar. Therefore, under-prediction more likely resulted from
underestimation of the Salmonella count after enrichment. Whether competition between these species also took place in the meat during enrichment is not known. However, as the observed levels of the competitive species were below 5.5 log10-units it is questionable whether interaction with S. Typhimurium DT104 in the pork could have occurred. Omitting these samples and using the 56 observations below 3 log10-units improved the percentage of predictions within APZ to 63 %.

CONCLUSIONS AND IMPACT OF THE STUDY
A novel approach for determining Salmonella counts at low concentrations was proposed. Applying a simple plate count method, after cold enrichment (11-16°C for 2 d) in the pork sample itself in combination with predictive growth models, showed promising results. It indicates the potential of this approach as an alternative to meet the need for more sensitive methods, which are simple enough to be used in large-scale series of analysis.

Correlation between Salmonella and hygiene indicators in the Danish fresh pork chain
Salmonella in pork is estimated to be the source to 200 – 400 registered cases of salmonellosis annually in Denmark. Hygiene performance during handling in all parts of the fresh pork chain will potentially contribute to the safety of the meat. This study describes the occurrence of Salmonella in 1,569 samples from cutting plants, and in 1,232 samples from retail supermarkets and butcher shops sampled from June 2010 to March 2011 and associates this to two hygiene indicators, enterococci and Enterobacteriaceae.

In six large cutting plants, Salmonella was isolated from 1.3 % compared 3.7 % of samples in 12 smaller plants. Process hygiene was described by quantifying Enterobacteriaceae and enterococci in samples and high levels of both were mostly seen for smaller plants. Enterococci counts varied more between plants than Enterobacteriaceae. Occurrence of Salmonella was positively correlated to the number of enterococci. If >10,000 enterococci/g were present, the sample was 14 times more likely to contain Salmonella compared to samples with fewer enterococci.

At retail, Salmonella was found in 0.72 % of cuttings from 278 supermarkets compared to 1.0 % for 134 butcher shops. Among samples, 4 % from supermarkets and 12 % from butcher shops contained enterococci. Samples containing enterococci were six times more likely to contain Salmonella whereas no correlation was found between Enterobacteriaceae and Salmonella in retail samples.

In conclusion, presence of Salmonella was associated with lower hygiene as indicated by high levels of either Enterobacteriaceae or enterococci. A positive correlation between enterococci and Salmonella was observed. In particular, smaller cutting plants had problems with hygiene and produced meat of higher consumer risk. To some extend this was also valid for butcher shops pointing at a need for interventions targeting smaller enterprises.
temperatures from 9.4 to 24.1 °C and with Salmonella inoculated in ground pork were used for evaluation of interaction models. The existing Jameson-effect and Lotka–Volterra species interaction models and a new expanded Jameson-effect model were evaluated. F-test indicated lack-of-fit for the classical Jameson-effect model at all of the tested temperatures and at 14.1–20.2 °C this was caused by continued growth of Salmonella after the natural microbiota had reached their max. population density. The new expanded Jameson-effect model and the Lotka–Volterra model performed better and appropriately described the continued but reduced growth of Salmonella after the natural microbiota had reached their max. population density. The expanded Jameson-effect model is a new and simple species interaction model, which performed as well as the more complex Lotka–Volterra model.

General information
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Organisations: Department of Systems Biology, National Food Institute, Division of Food Microbiology, Department of Microbiology, Division of Industrial Food Research, University of Bonn
Contributors: Møller, C., Ilg, Y., Aabo, S., Christensen, B. B., Dalgaard, P., Hansen, T. B.
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Web of Science (2013): Impact factor 3.374
ISI indexed (2013): ISI indexed yes
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Escherichia coli as indicator of the human Salmonella risk caused by consumption of pork

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Organisations: National Food Institute, Division of Food Microbiology, Division of Epidemiology and Microbial Genomics
Contributors: Bollerslev, A. M., Nauta, M., Hald, T., Hansen, T. B., Aabo, S.
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Source ID: u::10203
Research output: Chapter in Book/Report/Conference proceeding > Conference abstract in proceedings – Annual report year: 2013 > Research > peer-review

Hygiejneparametre
Physical sample structure as predictive factor in growth modeling of Listeria innocua in a white cheese model system

Growth of Listeria innocua at 9 °C was investigated in white cheeses manufactured from ultra-filtrate milk concentrate added varying amounts of skimmed milk powder, NaCl and glucono-delta-lactone. Characterization of the white cheese structures was performed using nuclear magnetic resonance (NMR) T2 relaxation parameters (relaxation times constants, relative areas and width of peaks) and their applicability as predictive factors for maximum specific growth rate, $\sqrt{\mu_{\text{max}}}$ and log-increase in 6 weeks of L. innocua was evaluated by polynomial modeling. Inclusion of NMR parameters was able to increase the goodness-of-fit of two basic models; one having pH, undissociated gluconic acid (GAu, mM) and NaCl (% w/v) as predictive factors and another having pH, GAu and aw as predictive factors. However, the best model fit was observed using $\sqrt{\mu_{\text{max}}}$ as response for the model including pH, GAu, aw and Width T21 revealing the lowest relative root mean squared errors of 14.0%. As the T2 relaxation population T21 is assigned to represent immobilized bulk water protons and the width T21 the heterogeneity of this water population, growth of L. innocua in white cheese seemed to be dependent on the heterogeneity of the immobilized bulk water present in cheese.
Predicting growth of C. perfringens in ready-to-eat foods kept hot for three hours

Growth potential of Clostridium perfringens in heated (75°C) ready-to-eat foods kept at temperatures between 20°C and 65°C was evaluated. It was examined at which temperatures the foods could be kept, without increasing the level of C. perfringens with more than 1 log cfu/g, over a period of three hours with varying characteristics such as pH, NaCl and cooling constant. Theoretical cooling constants were estimated at different locations in a small and large food (meatball and liver paste) using a variety of realistic heat transfer coefficients (5-500 W∙m⁻²∙K⁻¹) in a simulation software. Based on this, time/temperature profiles were simulated and the growth of C. perfringens was predicted using Combase Perfringens Predictor. Growth was predicted at pH 6 or 6.5 in combination with 0 – 3 % NaCl at temperatures between 20 and 65°C. Cooling constants varied between 0.2 h⁻¹ and 19 h⁻¹ and differed significantly within the food – especially in the large food type – indicating that it is not sufficient to evaluate growth of C. perfringens in the centre of the food. Moreover, it was found that keeping ready-to-eat-foods at temperatures above 52°C, having NaCl ≥3.0 % or pH ≤5.5 ensured that growth of C. perfringens was below 1 log cfu/g during a three-hour-storage regardless of the other parameters. For ready-to-eat foods where this is not the case, two tables (pH = 6.0 and pH = 6.5) was created showing which temperatures the foods can be kept at, dependent on the cooling constant.
Predicting outgrowth and inactivation of Clostridium perfringens in meat products during low temperature long time heat treatment

OBJECTIVE
Sous-vide cooking and molecular gastronomy has started a wave of experimenting with Low Temperature Long Time (LTLT) heat treatments. Heat treatments, at temperatures as low as 50°C, have been suggested by celebrity chefs. LTLT treatments often take hours to reach to the final core temperature and Cl. perfringens is, therefore, of special interest as it may outgrow during the coming up time and cause food safety problems. This study was undertaken to set up a predictive tool to establish the outgrowth potential of C. perfringens in LTLT meat products as a function of the applied heating profile.

METHODS
Challenge tests were performed at two dynamic temperature profiles (fast LTLT, 2.6 h from 10 to 53°C, and slow LTLT, 3.8 h from 10 to 53°C) with three types of inoculums (spores, heat-active spores and vegetative cells) of Cl. perfringens 790-94 in two different types of meat pork (pH 5.6) and chicken (pH adjusted to 6.8). Challenge tests representing LTLT treatments of beef were collected from the literature. The obtained growth data were used for evaluation of three different growth models originally validated for prediction of growth during cooling (Le Marc et al. 2008, Juneja et al. 2011, Jaloustre et al. 2011). The data in inactivation phase were used for evaluation of three inactivation models generated by Foegeding and Busta (1980), van Asselt and Zwietering (2006) and Jaloustre et al. (2012). Finally, a new growth model, derived from the model structure of Le Marc et al. (2008), was developed from literature data (215 isothermal growth data), and was combined with a linear inactivation model developed from data at 53°C from this study for completely predicting fate of Cl. perfringens during LTLT treatment.

RESULTS
Very short lag times were observed in most of the challenge tests, especially in high pH chicken. By using the acceptable prediction zone method, performance of literature models was evaluated and none of the growth and inactivation models could successfully predict the growth or inactivation of Cl. perfringens for the LTLT conditions of our challenge tests. Therefore, a new growth model and a new inactivation model were developed and combined to predict the overall fate of Cl. Perfringens during LTLT profiles at 53°C. However, predicted lag time was still much longer than the observed lag time in our challenge tests, which caused a general underestimation of growth giving rise to overestimation of inactivation in particular for chicken. To obtain more precise predictions, an RLT of 2-3 was recommended for chicken, independent on type of inoculums, and for vegetative cells in pork. For spores and heated spores in pork the increase of Cl. perfringens during LTLT coming up time never exceeded 1 log10-unit.

CONCLUSIONS AND IMPACT OF THE STUDY
A model combining both growth as well as inactivation for prediction of fate of Cl. perfringens during the LTLT treatment was developed. The model is the first predictive model specifically designed for LTLT treatment of meats. Very short lag times were observed during LTLT treatments, which were not observed in isothermal or cooling conditions previously. The reason for short lag time during slowly increasing temperature conditions, and how to predict it, should be interesting for future studies.

General information
Publication status: Published
Organisations: National Food Institute, Division of Industrial Food Research, Division of Food Microbiology, University of Copenhagen
Contributors: Duan, Z., Holst Hansen, T., Hansen, T. B., Dalgaard, P., Knechel, S.
Number of pages: 2
Publication date: 2013
Peer-reviewed: Yes
Source: dtu
Source ID: u::8733
Research output: Contribution to conference › Conference abstract for conference – Annual report year: 2013 › Research › peer-review

Quantitative Risk Assessment of Salmonella spp. in fresh pork

General information
Salmonella and indicator bacteria in pork: a comparison of butcher shops and supermarkets

General information
Publication status: Published
Organisations: National Food Institute, Division of Food Microbiology
Contributors: Hansen, T. B., Bollerslev, A. M., Sandø, G., Aabo, S.
Pages: 18-21
Publication date: 2013

Host publication information
Title of host publication: Annual Report on Zoonoses in Denmark 2012
Publisher: The National Food Institute, Technical University of Denmark
(Annual Report on Zoonoses in Denmark).
Source: dtu
Source ID: u::8359
Research output: Chapter in Book/Report/Conference proceeding

Salmonella i svinekød: opskæring og detail

General information
Publication status: Published
Organisations: National Food Institute, Division of Food Microbiology
Contributors: Hansen, T. B., Bollerslev, A. M., Sandø, G., Sommer, H. M., Aabo, S.
Publication date: 2013
Media of output: PowerPoint

Event information
Event: Møde i Landbrug og fødevarer
Location: Akselborg, København, Denmark
Research output: Non-textual form

"Conferm" - a new tool to predict reduction of pathogens during production of fermented and matured sausages

General information
Publication status: Published
Organisations: National Food Institute, Division of Food Microbiology, Danish Technological Institute
Contributors: Gunvig, A., Hansen, F., Borgaard, C., Hansen, T. B., Aabo, S.
Number of pages: 1
Pages: 91
Publication date: 2012

Host publication information
Title of host publication: XXIII FoodMicro 2012 : Abstract Book
Place of publication: Istanbul
Publisher: Istanbul Technical University
Editors: Heperkan, D., Karbancioglu-Guler, F., Daskaya-Dikmen, C.
ISBN (Print): 978-975-561-123-6
Research output: Chapter in Book/Report/Conference proceeding

Dietary proteins extend the survival of salmonella dublin in a gastric Acid environment.

The pH of the human stomach is dynamic and changes over time, depending on the composition of the food ingested and a number of host-related factors such as age. To evaluate the number of bacteria surviving the gastric acid barrier, we have developed a simple gastric acid model, in which we mimicked the dynamic pH changes in the human stomach. In the present study, model gastric fluid was set up to imitate pH dynamics in the stomachs of young and elderly people after ingestion of a standard meal. To model a serious foodborne pathogen, we followed the survival of Salmonella enterica serotype Dublin, and found that the addition of proteins such as pepsin, ovalbumin, and blended turkey meat to the simple gastric acid model significantly delayed pathogen inactivation compared with the control, for which no proteins were added. In contrast, no delay in inactivation was observed in the presence of bovine serum albumin, indicating that protection could be protein specific. The simple gastric acid model was validated against a more laborious and complex fermenter model, and similar survival of Salmonella Dublin was observed in both models. Our gastric acid model allowed us to evaluate the influence of food components on survival of pathogens under gastric conditions, and the model could contribute to a broader understanding of the impact of specific food components on the inactivation of pathogens during gastric passage.
Evaluation of growth potential of *Listeria monocytogenes* and *Salmonella* in a sandwich environment

**General information**
- **Publication status:** Published
- **Organisations:** National Food Institute, Division of Food Microbiology
- **Contributors:** Birk, T., Møller, C., Bollerslev, A. M., Aabo, S., Karapetian, D., Hansen, T. B.
- **Number of pages:** 1
- **Publication date:** 2012

**Host publication information**
- **Title of host publication:** 2012 Symposium of The Danish Microbiological Society
- **Publisher:** DMS

**Bibliographical note**
- **P60**
- **Research output:** Chapter in Book/Report/Conference proceeding  Conference abstract in proceedings – Annual report year: 2012  Research  peer-review

**Evaluation of growth potential of *Listeria monocytogenes* and *Salmonella* in a sandwich environment**

**General information**
- **Publication status:** Published
- **Organisations:** National Food Institute, Division of Food Microbiology
- **Contributors:** Birk, T., Aabo, S., Hansen, T. B.
- **Number of pages:** 1
- **Publication date:** 2012
- **Peer-reviewed:** Yes
- **Event:** Abstract from 10th Symposium on Food Microbiology, Helsingør, Denmark.
- **Electronic versions:** LMC_2012.pdf

**Bibliographical note**
- **Nr. 26**
- **Source:** dtu
- **Source ID:** u:6327
- **Research output:** Contribution to conference  Conference abstract for conference – Annual report year: 2013  Research  peer-review

**Evaluation of growth potential of *Listeria monocytogenes* and *Salmonella* in a sandwich environment**

**General information**
- **Publication status:** Published
- **Organisations:** National Food Institute, Division of Food Microbiology
- **Contributors:** Birk, T., Bollerslev, A. M., Møller, C., Aabo, S., Hansen, T. B.
- **Number of pages:** 1
- **Publication date:** 2012
- **Peer-reviewed:** Yes
- **Event:** Poster session presented at 23rd International ICFMH Symposium, FoodMicro 2012, Istanbul, Turkey.
- **Electronic versions:** 11.pdf
- **Research output:** Contribution to conference  Poster – Annual report year: 2013  Research  peer-review

**Forekomst af indikatorbakterier og Salmonella i svinekød og på udstyr hos detailslagtere: Foreløbige opgørelse af detailledsprojekt CKL 2009-20-64-00179**

**General information**
- **Publication status:** Published
Input to electronic food safety management tools in catering

More and more meals and meal components are being prepared outside the home by caterers often in a semi-industrialized scale. In Denmark it is estimated that one third of the food consumed is prepared within the catering sector. This includes canteens, meals-on-wheels, restaurants and fast-food outlets, hospitals and nursing homes, nurseries etc. Often a great variety of raw materials and cooking processes are used. This requires a high degree of food safety know-how and management skills in the kitchens. Although a short course in food hygiene is mandatory, the labour force may be transient and without an integrated understanding of food safety issues. Information technology can be used to help
transform expert knowledge into safer working procedures. A software and a database platform has been developed setting safe performance criteria for heating and cooling processes for different types of foods depending on e.g. whether the food is to be eaten at once or kept chill stored afterwards. These factors have been incorporated into a commercial software calculating process criteria. The software is user friendly and it is gaining popularity both with the production sites and the inspection officers. A simple questionnaire helps the production site to identify the critical control points and target values. Danish style open-faced sandwiches as well as other sandwiches constitute a major part of the meals and they are characterized by not being heated prior to consumption and by the mix of different heat-treated and raw ingredients. For this purpose other types of data such as germination and relative lag time data at different chill temperatures are currently being generated and validated for incorporation in order to create an even more versatile IT tool. This tool can be integrated with time-temperature sensors sending warnings regarding the end of safe shelf life.

General information
Publication status: Published
Organisations: National Food Institute, Division of Food Microbiology, Videnscenter for Fødevarer og Sundhed, University of Copenhagen
Contributors: Knøchel, S., Hansen, H., Hansen, B., Kamuk, A., Christensen, B., Hansen, T. B.
Publication date: 2012
Peer-reviewed: Yes
Event: Abstract from Food Safety Management 2012, Cipping Campden, United Kingdom.

Bibliographical note
Oral presentation
Source: dtu
Source ID: u::6174
Research output: Contribution to conference › Conference abstract for conference – Annual report year: 2012 › Research › peer-review

Modelling transfer of Salmonella Typhimurium DT104 during simulation of grinding of pork
Aims: The aim of this study was to develop a model to predict cross-contamination of Salmonella during grinding of pork. Methods and Results: Transfer rates of Salmonella were measured in three experiments, where between 10 and 20 kg meat was ground into 200-g portions. In each experiment, five pork slices of about 200 g per slice were inoculated with 8–9 log-units of Salmonella Typhimurium DT104 and used for building up the contamination in the grinder. Subsequently, Salmonella-free slices were ground and collected as samples of c. 200 g minced pork. Throughout the process, representative samples were quantitatively analysed for Salmonella. A model suggested by Nauta et al. (2005) predicting cross-contamination of Campylobacter in poultry processing and two modified versions of this model were tested. Conclusions: The present study observed a tailing phenomenon of transfer of Salmonella during a small-scale grinding process. It was, therefore, hypothesized that transfer occurred from two environmental matrices inside the grinder and a model was developed. The developed model satisfactorily predicted the observed concentrations of Salmonella during its cross-contamination in the grinding of up to 110 pork slices. Significance and Impact of the Study: The proposed model provides an important tool to examine the effect of cross-contamination in quantitative microbial risk assessments and might also be applied to various other food processes where cross-contamination is involved.

General information
Publication status: Published
Organisations: Division of Microbiology and Risk Assessment, National Food Institute, Division of Industrial Food Research, University of Copenhagen
Contributors: Möller, C., Nauta, M., Christensen, B. B., Dalgaard, P., Hansen, T. B.
Pages: 90-98
Publication date: 2012
Peer-reviewed: Yes

Publication information
Journal: Journal of Applied Microbiology
Volume: 112
Issue number: 1
ISSN (Print): 1364-5072
Ratings:
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.51
Web of Science (2012): Impact factor 1.629
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
Original language: English
Keywords: Grinding, Pork, Retail, Salmonella, Cross-contamination, Modelling
DOIs:
**Water Properties in Cream Cheeses with Variations in pH, Fat, and Salt Content and Correlation to Microbial Survival**

Water mobility and distribution in cream cheeses with variations in fat (4, 15, and 26%), added salt (0, 0.625, and 1.25%), and pH (4.2, 4.7, and 5.2) were studied using H-1 NMR relaxometry. The cheese samples were inoculated with a mixture of Listeria innocua, Escherichia coli 0157 and Staphylococcus aureus, and partial least-squares regression revealed that H-1 T-2 relaxation decay data were able to explain a large part of the variation in the survival of E. coli O157 (64-83%). However, the predictions of L. innocua and S. aureus survival were strongly dependent on the fat/water content of the samples. Consequently, the present results indicate that NMR relaxometry is a promising technique for predicting the survival of these bacteria; however, the characteristics of the sample matrix are substantial.

**General information**

Publication status: Published
Organisations: National Food Institute, Division of Microbiology and Risk Assessment, Aarhus University, Arla Foods
Pages: 1635-1644
Publication date: 2012
Peer-reviewed: Yes

**Publication information**

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Volume: 60
Issue number: 7
ISSN (Print): 0021-8561
Ratings:
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 3.2 SJR 1.408 SNIP 1.474
Web of Science (2012): Impact factor 2.906
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
Original language: English
Keywords: Agriculture, Chemistry, Food, Nuclear-Magnetic-Resonance, Staphylococcus-Aureus, NMR Relaxometry, Mobility, Relaxation, Systems, Fermentation, Coagulation, Temperature, H-1-NMR
DOIs:
10.1021/jf204371v
Source: dtu
Source ID: n:oai:DTIC-ART:isi/358324420::15273
Research output: Contribution to journal › Journal article – Annual report year: 2012 › Research › peer-review

**Growth and survival of exponential and stationary phase Salmonella during sausage fermentation**

**General information**

Publication status: Published
Organisations: Division of Microbiology and Risk Assessment, National Food Institute
Contributors: Birk, T., Müller, K., Hansen, T. B., Aabo, S.
Number of pages: 416
Publication date: 2011

**Host publication information**

Title of host publication: Safepork 2011 : Abstract book
Electronic versions:
plugin-SP010_abstractbook_web_140611.pdf
URLs:
http://www.safepork.org/
Source: orbit
Source ID: 277971
Research output: Chapter in Book/Report/Conference proceeding › Conference abstract in proceedings – Annual report year: 2011 › Research
Modelling transfer of Salmonella Typhimurium DT104 during the grinding of pork

General information
Publication status: Published
Organisations: Division of Microbiology and Risk Assessment, National Food Institute
Contributors: Møller, C., Nauta, M., Christensen, B. B., Dalgaard, P., Hansen, T. B.
Pages: 37-40
Publication date: 2011

Host publication information
Title of host publication: Predictive Modelling of Food Quality and Safety: Conference Proceedings
Editors: Cummins, E., Frias, J. M., Valdramidis, V. P.
Keywords: Pork, Salmonella, Cross contamination, Modelling
URLs:
http://www.eventelephant.com/pmf7
Source: orbit
Source ID: 284721
Research output: Chapter in Book/Report/Conference proceeding – Annual report year: 2011 › Research › peer-review

Quantifying the effect of natural microbiota on growth of Salmonella Typhimurium DT104 and Salmonella Derby in fresh pork

General information
Publication status: Published
Organisations: National Food Institute, Division of Food Microbiology, Division of Industrial Food Research, University of Copenhagen, University of Bonn
Contributors: Møller, C. O. D. A., Ilg, Y., Aabo, S., Dalgaard, P., Bak Christensen, B., Hansen, T. B.
Number of pages: 1
Publication date: 2011
Peer-reviewed: Yes
Event: Poster session presented at 9th International Conference on the Epidemiology and Control of Biological Chemical and Physical Hazards in Pigs and Pork, Maastricht, Netherlands.
Electronic versions:
Hansen_Final.pdf
Source: PublicationPreSubmission
Source ID: 93297027
Research output: Contribution to conference › Poster – Annual report year: 2011 › Research › peer-review

Quantifying the effect of natural microflora on growth of salmonellae in fresh pork

General information
Publication status: Published
Organisations: Division of Microbiology and Risk Assessment, National Food Institute, University of Bonn
Contributors: Birk, T., Hansen, T. B., Møller, C., Ilg, Y., Aabo, S., Dalgaard, P., Christensen, B. B.
Number of pages: 168
Publication date: 2011

Host publication information
Title of host publication: Safepork 2011: Abstract Book
Electronic versions:
plugin-SP010_abstractbook_web_140611.pdf
URLs:
http://www.safepork.org/
Source: orbit
Source ID: 277976
Research output: Chapter in Book/Report/Conference proceeding › Conference abstract in proceedings – Annual report year: 2011 › Research

Quantifying the effect of natural microflora on growth of Salmonella Typhimurium DT104 and Salmonella Derby in fresh pork
Rapid Quantification of Viable Campylobacter from Chicken Carcasses, Using Real-time PCR and Propidium Monoazide Treatment, as a Tool for Quantitative Risk Assessment

Salmonella i detailslagtere: Opgørelse af detailledsprojekt CKL 2010-20-64-00219

Salmonella i opskæringsvirksomheder: Opgørelse af opskæringsprojekt CKL 2010-20-64-00220
Suggestion for a decision support tool (DST) for corrective storage of sausages suspected of VTEC survival during fermentation and maturation

General information
Publication status: Published
Organisations: Division of Microbiology and Risk Assessment, National Food Institute, Danish Technological Institute
Contributors: Hansen, T. B., Gunvig, G., Larsen, H. D., Hansen, F., Aabo, S.
Pages: 122-125
Publication date: 2011

Host publication information
Title of host publication: Predictive Modelling of Food Quality and Safety: Conference Proceedings
Editors: Cummins, E., Frias, J. M., Valdramidis, V. P.
Keywords: Corrective Action, CCP, VTEC 026:H-, VTEC 0157, VTEC 0111:H-
URLs:
http://www.eventelephant.com/pmf7
Source: orbit
Source ID: 284717
Research output: Chapter in Book/Report/Conference proceeding – Article in proceedings – Annual report year: 2011 – Research
peer-review

Survival and growth of exponential and stationary phase Salmonelladuring fermentation of sausage

General information
Publication status: Published
Organisations: Division of Microbiology and Risk Assessment, National Food Institute
Contributors: Birk, T., Müller, K., Hansen, T. B., Aabo, S.
Publication date: 2011
Peer-reviewed: No
Event: Poster session presented at 9th International Conference on the Epidemiology and Control of Biological Chemical and Physical Hazards in Pigs and Pork, Maastricht, Netherlands.
Electronic versions:
Birk.pdf
URLs:
http://www.safepork.org/
Source: orbit
Source ID: 278027
Research output: Contribution to conference – Poster – Annual report year: 2011 – Research

Rapid Quantification of Viable Campylobacter Bacteria on Chicken Carcasses, Using Real-Time PCR and Propidium Monoazide Treatment, as a Tool for Quantitative Risk Assessment

A number of intervention strategies against Campylobacter contaminated poultry focus on post-slaughter reduction of the number of cells, emphasizing the need for rapid and reliable quantitative detection of only viable Campylobacter. We present a new and rapid quantitative approach for enumeration of foodborne Campylobacter, combining real-time PCR (Q-PCR) with a simple propidium monoazide (PMA) sample treatment. In less than 3 hours, this method generates a signal from only viable and viable but non-culturable (VBNC) Campylobacter with an intact membrane. The method performance was evaluated by assessing the contribution to variability from individual chicken carcass rinse matrices, species of Campylobacter, and the efficiency of DNA extraction with differing cell inputs. The method was compared with culture-based enumeration on 50 naturally infected chickens. The cell contents correlated with Ct-values (R(2) = 0.993), with a quantification range from 1x10(2)-1x10(7) CFU/ml. The correlation between the Campylobacter counts obtained by PMA-PCR and culture on naturally contaminated chickens was high (R(2) = 0.844). The amplification efficiency of the Q-PCR method was not affected by chicken rinse matrix or by species of Campylobacter. No Q-PCR signals were obtained from artificially inoculated chicken rinse when PMA sample treatment was applied. In conclusion, this study presents a rapid tool for producing reliable quantitative data on viable Campylobacter in chicken carcass rinse. The proposed method does not detect DNA from dead Campylobacter, but recognises the infectious potential of the VBNC state, and is thereby able to assess the effect of control strategies, and provide trustworthy data for risk assessment.
Den videnskabelige baggrund for værktøjerne

General information
Publication status: Published
Organisations: National Food Institute, Division of Microbiology and Risk Assessment
Contributors: Hansen, T. B.
Publication date: 2010

Event information
Event: Netværksmøde for storkøkkener : Temadag om risikovurdering
Location: Octavia, Maglegaardsvej, Roskilde
Source: orbit
Source ID: 256909
Research output: Non-textual form › Sound/Visual production (digital) – Annual report year: 2010 › Research

Effect of natural microflora on growth of Salmonella in fresh pork meat - a predictive microbiology approach

General information
Publication status: Published
Organisations: Division of Microbiology and Risk Assessment, National Food Institute, Division of Seafood Research, FoodDTU, University of Bonn
Contributors: Møller, C., Kampmann, Y., Aabo, S., Christensen, B. B., Dalgaard, P., Hansen, T. B.
Number of pages: 51
Publication date: 2010

Host publication information
Title of host publication: FMN - 8th Symposium on Food Microbiology : 2-3 June 2010
Publisher: The Centre for Advanced Food Studies (LMC)
Source: orbit
Source ID: 263673
Research output: Chapter in Book/Report/Conference proceeding › Conference abstract in proceedings – Annual report year: 2010 › Research

Effect of natural microflora on growth of Salmonella in fresh pork meat - a predictive microbiology approach

General information
Publication status: Published
Organisations: Division of Microbiology and Risk Assessment, National Food Institute, Division of Seafood Research, FoodDTU, University of Bonn
Contributors: Møller, C., Kampmann, Y., Aabo, S., Christensen, B. B., Dalgaard, P., Hansen, T. B.
Publication date: 2010
Peer-reviewed: No
Event: Poster session presented at 8th Symposium on Food Microbiology, Helsingør, Denmark.
Source: orbit
Source ID: 263675
Research output: Contribution to conference › Poster – Annual report year: 2010 › Research

Effect of natural microflora on growth of Salmonella in fresh pork meat - a predictive microbiology approach
Egenkontrol

General information
Publication status: Published
Organisations: National Food Institute, Division of Microbiology and Risk Assessment
Contributors: Hansen, T. B.
Publication date: 2010

Event information
Event: Strategidag : Fødevarestyrelsen (4. kontor) og DTU Fødevareinstituttet (afd. M)
Location: FVST, Mørkhøj
Source: orbit
Source ID: 268269
Research output: Non-textual form › Sound/Visual production (digital) – Annual report year: 2010 › Research

Gaining more from pilot-plant studies: An example for VTEC in fermented semi-dried sausages

General information
Publication status: Published
Organisations: Division of Microbiology and Risk Assessment, National Food Institute, Danish Technological Institute
Contributors: Hansen, T. B., Gunvig, A., Hansen, F., Aabo, S.
Number of pages: 349
Publication date: 2010

Host publication information
Title of host publication: 22nd International ICFMH Symposium, Food Micro 2010 : Final programme & Abstract Book
Place of publication: Denmark
Publisher: Kandrup Bogtrykkeri A/S
Source: orbit
Source ID: 266762
Research output: Chapter in Book/Report/Conference proceeding › Conference abstract in proceedings – Annual report year: 2010 › Research

Gaining more from pilot-plant studies: An example for VTEC in fermented semi-dried sausages

General information
Publication status: Published
Organisations: Division of Microbiology and Risk Assessment, National Food Institute, Danish Technological Institute
Contributors: Hansen, T. B., Gunvig, A., Hansen, F., Aabo, S.
Number of pages: 1
Publication date: 2010
Peer-reviewed: No
Event: Poster session presented at 22nd International ICFMH Symposium, Copenhagen, Denmark.
Electronic versions:
VTEC_poster260810.pdf
Source: orbit
Source ID: 266763
Research output: Contribution to conference › Poster – Annual report year: 2010 › Research

Growth of Salmonella in minced meat after freezing

General information
Publication status: Published
Organisations: Division of Microbiology and Risk Assessment, National Food Institute
Contributors: Birk, T., Hansen, T. B., Aabo, S.
Publication date: 2010
Peer-reviewed: No
Event: Poster session presented at 22nd International ICFMH Symposium, Copenhagen, Denmark.
Source: orbit
Source ID: 272031
Research output: Contribution to conference › Poster – Annual report year: 2010 › Research
Growth of Salmonella in minced meat after freezing

General information
Publication status: Published
Organisations: Division of Microbiology and Risk Assessment, National Food Institute
Contributors: Birk, T., Hansen, T. B., Aabo, S.
Number of pages: 349
Publication date: 2010

Host publication information
Title of host publication: 22nd International ICFMH Symposium, Food Micro 2010: Final programme & Abstract Book
Place of publication: Copenhagen, Denmark
Publisher: Kandrups Bogtrykkeri A/S
Source: orbit
Source ID: 272030
Research output: Chapter in Book/Report/Conference proceeding › Conference abstract in proceedings – Annual report year: 2010 › Research

Rapid quantification of viable Campylobacter on chicken carcasses by real-time PCR and propidium monoazide as a tool for quantitative risk assessment

A number of intervention strategies against Campylobacter contaminated poultry focus on post-slaughter reduction of the number of cells, emphasizing the need for rapid and reliable quantitative detection of only viable Campylobacter. We present a new and rapid quantitative approach for enumeration of foodborne Campylobacter, combining real-time PCR (Q-PCR) with a simple propidium monoazide (PMA) sample treatment. In less than 3 hours, this method generates a signal from only viable and viable but non-culturable (VBNC) Campylobacter with an intact membrane. The method performance was evaluated by assessing the contribution to variability from individual chicken carcass rinse matrices, species of Campylobacter, and the efficiency of DNA extraction with differing cell inputs. The method was compared with culture-based enumeration on 50 naturally infected chickens. The cell contents correlated with Ct-values (R² = 0.993), with a quantification range from 1×10^2 to 1×10^7 CFU/ml. The correlation between the Campylobacter counts obtained by PMA-PCR and culture on naturally contaminated chickens was high (R² = 0.844). The amplification efficiency of the Q-PCR method was not affected by chicken rinse matrix or by species of Campylobacter. No Q-PCR signals were obtained from artificially inoculated chicken rinse when PMA sample treatment was applied. In conclusion, this study presents a rapid tool for...
producing reliable quantitative data on viable Campylobacter in chicken carcass rinse. The proposed method does not detect DNA from dead Campylobacter, but recognises the infectious potential of the VBNC state, and is thereby able to assess the effect of control strategies, and provide trustworthy data for risk assessment.

General information
Publication status: Published
Organisations: Division of Microbiology and Risk Assessment, National Food Institute, University of Copenhagen
Contributors: Josefsen, M. H., Löfström, C., Hansen, T. B., Christensen, L. S., Olsen, J. E., Hoorfar, J.
Number of pages: 51
Pages: PSC1.06
Publication date: 2010

Host publication information
Title of host publication: 22nd International ICFMH Symposium Food Micro 2010
Source: orbit
Source ID: 271026
Research output: Chapter in Book/Report/Conference proceeding » Conference abstract in proceedings – Annual report year: 2010 » Research

Salmonella in pork cuttings in supermarkets and butchers' shops in Denmark in 2002 and 2006

General information
Publication status: Published
Organisations: Division of Microbiology and Risk Assessment, National Food Institute
Contributors: Hansen, T. B., Christensen, B. B., Aabo, S.
Pages: 23-29
Publication date: 2010
Peer-reviewed: Yes

Publication information
Journal: Zoonoses and Public Health
Volume: 57
Issue number: 1
ISSN (Print): 1863-1959
Ratings:
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 0.869 SNIP 1.14
Web of Science (2010): Impact factor 2.22
Web of Science (2010): Indexed yes
Original language: English
DOIs:
10.1111/j.1863-2378.2010.01360.x
Source: orbit
Source ID: 269466
Research output: Contribution to journal » Conference article – Annual report year: 2010 » Research » peer-review

Sikker varmebehandling

General information
Publication status: Published
Organisations: National Food Institute, Division of Microbiology and Risk Assessment
Contributors: Hansen, T. B.
Publication date: 2010

Event information
Event: Kulinarisk kvalitet med fokus på risikovurdering og egenkontrol
Location: Roskilde, Denmark
Source: orbit
Source ID: 259416
Research output: Non-textual form » Sound/Visual production (digital) – Annual report year: 2010 » Research

Survival and growth of exponential and stationary phase Salmonella in meat juice after freezing
General information
Publication status: Published
Organisations: Division of Microbiology and Risk Assessment, National Food Institute
Contributors: Birk, T., Hansen, T. B., Aabo, S.
Number of pages: 51
Publication date: 2010

Host publication information
Title of host publication: FMN - 8th Symposium on Food Microbiology
Publisher: LMC
Source: orbit
Source ID: 263742
Research output: Chapter in Book/Report/Conference proceeding › Conference abstract in proceedings – Annual report year: 2010 › Research

Varmebehandlingsteori

General information
Publication status: Published
Organisations: National Food Institute, Division of Microbiology and Risk Assessment
Contributors: Hansen, T. B.
Publication date: 2010

Event information
Event: Kulinarisk kvalitet med fokus på risikovurdering og egenkontrol
Location: Roskilde, Denmark
Source: orbit
Source ID: 259415
Research output: Non-textual form › Sound/Visual production (digital) – Annual report year: 2010 › Research

Changes in Salmonella prevalence in pork cuttings in supermarkets and butchers' shops in Denmark from 2002 to 2006

General information
Publication status: Published
Organisations: Division of Microbiology and Risk Assessment, National Food Institute
Contributors: Hansen, T. B., Aabo, S.
Publication date: 2009

Event information
Event: 8th International Symposium, Epidemiology and Control of Foodborne Pathogens in Pork
Location: Quebec City, Canada
Source: orbit
Source ID: 250761
Research output: Non-textual form › Sound/Visual production (digital) – Annual report year: 2009 › Research

Changes in Salmonella prevalence in pork cuttings in supermarkets and butchers' shops in Denmark from 2002 to 2006

General information
Publication status: Published
Organisations: Division of Microbiology and Risk Assessment, National Food Institute
Contributors: Hansen, T. B., Christensen, B. B., Aabo, S.
Number of pages: 411
Pages: 197-200
Publication date: 2009

Host publication information
Title of host publication: Proceedings 8th International Symposium, Epidemiology and Control of Foodborne Pathogens in Pork: September 30th to October 2nd 2009, Quebec City, Quebec, Canada
Place of publication: Quebec, Canada
Publisher: Agricultural, Pêcheries et Alimentation; Université de Montréal
Source: orbit
Source ID: 250757
Research output: Chapter in Book/Report/Conference proceeding › Article in proceedings – Annual report year: 2009 › Research
Clash between Technology and Management: - challenges for SMEs

General information
Publication status: Published
Organisations: FoodDTU, Department of Management Engineering, Innovation and Sustainability, National Food Institute, Division of Microbiology and Risk Assessment
Contributors: Nielsen, T., Hansen, T. B., Kristensen, N. H., Christensen, B. B.
Publication date: 2009

Event information
Event: HACCP based food safety
Location: Højstrupgård, Helsingør, Denmark
Source: orbit
Source ID: 255383
Research output: Non-textual form › Sound/Visual production (digital) – Annual report year: 2009 › Research

Comparison of three Listeria monocytogenes strains in a guinea-pig model simulating food-borne exposure

Three different Listeria monocytogenes strains, LO28 (a laboratory strain with truncated InlA), 4446 (a clinical isolate) and 7291 (a food isolate), were compared in a guinea-pig model designed to mimic food-borne exposure. The objectives were (1) to verify the applicability of the animal model for distinguishing between Listeria with different virulence properties and (2) to explore whether it was possible to reduce the required number of animals by dosing with mixed cultures instead of monocultures. Consistent with in vitro observations of infectivity in Caco-2 cells, faecal densities and presence in selected organs were considerably lower for LO28 than for the other two strains. Additionally, the animal study revealed a difference in prevalence in faeces as well as in internal organs between the clinical isolate and the food isolate, which was not reproduced in vitro. Dosage with monocultures of Listeria strains gave similar results as dosage with a mixture of the three strains; thus, the mixed infection approach was a feasible way to reduce the number of animals needed for determination of listerial virulence.

General information
Publication status: Published
Organisations: National Food Institute, Division of Microbiology and Risk Assessment
Contributors: Roldgaard, B., Andersen, J. B., Hansen, T. B., Christensen, B. B., Licht, T. R.
Pages: 88-94
Publication date: 2009
Peer-reviewed: Yes

Publication information
Journal: F E M S Microbiology Letters
Volume: 291
Issue number: 1
ISSN (Print): 0378-1097
Ratings:
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.13 SNIP 0.836
Web of Science (2009): Indexed yes
Original language: English
Keywords: fluorescence, virulence, guinea-pig, Listeria
DOIs: 10.1111/j.1574-6968.2008.01439.x
Source: orbit
Source ID: 250114
Research output: Contribution to journal › Journal article – Annual report year: 2009 › Research › peer-review

Do we know the safety effect of HACCP? - and can we measure it?

General information
Publication status: Published
Organisations: National Food Institute, Division of Microbiology and Risk Assessment, Department of Management Engineering, Innovation and Sustainability
Contributors: Christensen, B. B., Hansen, T. B., Nielsen, T., Kristensen, N. H.
Publication date: 2009
Egenkontrol i catering

**General information**
Publication status: Published
Organisations: Division of Microbiology and Risk Assessment, National Food Institute, Innovation and Sustainability, Department of Management Engineering
Contributors: Hansen, T. B., Christensen, B. B., Kristensen, N. H., Nielsen, T.
Pages: 15
Publication date: 2009
Peer-reviewed: Unknown

**Publication information**
Journal: Scandinavian Food & Drink
Volume: 1
ISSN (Print): 0909-3818
Original language: Danish
URLs:
http://www.swiflet.com/tm/scf/1/1/
Source: orbit
Source ID: 245454
Research output: Contribution to journal › Journal article – Annual report year: 2009 › Communication

Microbiological profiles of dairy farm red smear cheese made from pasteurized and un-pasteurized milk

**General information**
Publication status: Published
Organisations: Division of Microbiology and Risk Assessment, National Food Institute, Aarhus University, University of Copenhagen
Number of pages: 44
Publication date: 2009

**Host publication information**
Title of host publication: 7th Symposium on Food Microbiology
Place of publication: Copenhagen
Publisher: LMC
Keywords: safety, cheese, microbiology
Source: orbit
Source ID: 243488
Research output: Chapter in Book/Report/Conference proceeding › Conference abstract in proceedings – Annual report year: 2009 › Research

Microbiological profiles of dairy farm red smear cheese made from pasteurized and un-pasteurized milk

**General information**
Publication status: Published
Organisations: Division of Microbiology and Risk Assessment, National Food Institute, Aarhus University, University of Copenhagen
Publication date: 2009
Peer-reviewed: No
Event: Poster session presented at 7th Symposium of Food Microbiology, Helsingør, Denmark.
Source: orbit
Source ID: 245373
Research output: Contribution to conference › Poster – Annual report year: 2009 › Research
Using ComBase Predictor and Pathogen Modeling Program as support tools in outbreak investigation: an example from Denmark

During a 20-case outbreak of verocytotoxin-producing Escherichia coli O26:H11 in 2007 in Denmark, two of the cases were also found to be infected with Yersinia enterocolitica. The source was an organic semi-dried fermented sausage and the question was: “Could Y. enterocolitica have survived, or even multiplied, during the production of the suspected sausage?” To elucidate this, the ComBase Predictor (CBP) and the Pathogen Modeling Program (PMP) were used as support tools. From information on the company’s website, it was calculated that the water phase salt changed from 4.6% to 8.0% during production and pH changed from 5.5 to 4.7. No nitrite was used. Predictions of growth/reduction of Y. enterocolitica and E. coli in a matrix covering these pH- and WPS-values were compared at 24°C mimicking fermentation temperature, at 16 and 5°C mimicking drying and storage temperatures, respectively. The results showed that Y. enterocolitica would be able to multiply during the first part of the production. Compared to E. coli growth of Y. enterocolitica was predicted to be slower in the beginning of the fermentation but faster in the end with CBP and faster during the whole fermentation with PMP. CBP predicted that an increase of one log-unit took approx. 50 h at conditions in the beginning of the drying period and approx. 100 h in the middle. During storage growth of Y. enterocolitica would only be expected in case of production failures, such as insufficient drying or addition of a too low amount of salt to the batter. A deterministic model was constructed in Microsoft Excel using information on the production of the implicated sausage. This model predicted the level of Y. enterocolitica to increase 2.3, 4.2 and 7.8 log-units during fermentation, drying and storage, respectively. At the point of release of the sausage for sale, 1 Y. enterocolitica could have increased to 106 and the sausage could, therefore, not be ruled out as the source of Y. enterocolitica found in two of the outbreak cases.
Using ComBase Predictor and Pathogen Modeling Program as support tools in outbreak investigation: an example from Denmark

During a 20-case-outbreak of verocytotoxin-producing Escherichia coli O26:H11 in 2007 in Denmark, two of the cases were also found to be infected with Yersinia enterocolitica. The source was an organic semi-dried fermented sausage and the question was: “Could Y. enterocolitica have survived, or even multiplied, during the production of the suspected sausage?” To elucidate this, the ComBase Predictor (CBP) and the Pathogen Modeling Program (PMP) were used as support tools. From information on the company’s website, it was calculated that the water phase salt changed from 4.6% to 8.0% during production and pH changed from 5.5 to 4.7. No nitrite was used. Predictions of growth/reduction of Y. enterocolitica and E. coli in a matrix covering these pH- and WPS-values were compared at 24°C mimicking fermentation temperature, at 16 and 5°C mimicking drying and storage temperatures, respectively. The results showed that Y. enterocolitica would be able to multiply during the first part of the production. Compared to E. coli growth of Y. enterocolitica was predicted to be slower in the beginning of the fermentation but faster in the end with CBP and faster during the whole fermentation with PMP. CBP predicted that an increase of one log-unit took approx. 50 h at conditions in the beginning of the drying period and approx. 100 h in the middle. During storage growth of Y. enterocolitica would only be expected in case of production failures, such as insufficient drying or addition of a too low amount of salt to the batter. A deterministic model was constructed in Microsoft Excel using information on the production of the implicated sausage. This model predicted the level of Y. enterocolitica to increase 2.3, 4.2 and 7.8 log-units during fermentation, drying and storage, respectively. At the point of release of the sausage for sale, 1 Y. enterocolitica could have increased to 106 and the sausage could, therefore, not be ruled out as the source of Y. enterocolitica found in two of the outbreak cases.

Future progress in consumer safety of pork in Denmark may depend on carcass decontamination

General information
Publication status: Published
Organisations: Division of Microbiology and Risk Assessment, National Food Institute
Contributors: Aabo, S., Christiansen, P., Hansen, T. B., Krag, R., Sommer, H. M.
Publication date: 2008
Guidelines for regional food authorities to establish science based food safety programmes

General information
Publication status: Published
Organisations: Division of Microbiology and Risk Assessment, National Food Institute
Contributors: Hansen, T. B., Aabo, S., Rosenquist, H., Christensen, B. B., Nielsen, N. L., Bondt, N., Wagenberg, C. V., Petersen, B.
Pages: 166-179
Publication date: 2008

Host publication information
Title of host publication: “from stable to table”, Food Safety and Quality in International Food Chains : Technical Reports of the Interreg IIIC Initiative PromSTAP
Place of publication: Düsseldorf, Germany
Publisher: Ministry of the Environment and Nature Conservation, Agriculture and Consumer Protection of the State of North Rhine-Westphalia
ISBN (Print): 978-3-00-023664-8
Source: orbit
Source ID: 234259
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HACCP systems

General information
Publication status: Published
Organisations: Division of Microbiology and Risk Assessment, National Food Institute
Contributors: Hansen, T. B.
Publication date: 2008

Event information
Event: The 2nd Workshop arranged by SAFOODNET
Location: DTU, Lyngby, Denmark
Source: orbit
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HACCP systems

General information
Publication status: Published
Organisations: Division of Microbiology and Risk Assessment, National Food Institute
Contributors: Hansen, T. B.
Publication date: 2008
Peer-reviewed: No
Event: Abstract from Workshop arranged by SAFOODNET - Microbial risk management in food processes, DTU, Lyngby, Denmark,
Source: orbit
Source ID: 233938
Research output: Contribution to conference – Conference abstract for conference – Annual report year: 2008 – Research

Innovative Systems in the field of food quality and safety

General information
Publication status: Published
Microbiological profiles of dairy farm red smear cheese made from pasteurized and un-pasteurized milk

General information
Publication status: Published
Organisations: Division of Microbiology and Risk Assessment, National Food Institute
Publication date: 2008
Peer-reviewed: No
Event: Poster session presented at 21st International ICFMH Symposium, Aberdeen, United Kingdom.
Source: orbit
Source ID: 233941
Research output: Contribution to conference › Poster – Annual report year: 2008 › Research

Predicting growth of Salmonella in fresh pork products

General information
Publication status: Published
Organisations: Division of Microbiology and Risk Assessment, National Food Institute, Section for Aquatic Microbiology and Seafood Hygiene, National Institute of Aquatic Resources
Contributors: Møller, C., Hansen, T. B., Kampmann, Y., Aabo, S., Dalgaard, P., Christensen, B. B.
Publication date: 2008

Event information
Event: 3rd International Workshop
Location: Bonn, Germany
Source: orbit
Source ID: 234742
Research output: Non-textual form › Sound/Visual production (digital) – Annual report year: 2008 › Research
A collaborative study on a Nordic standard protocol for detection and enumeration of thermotolerant Campylobacter in food (NMKL 119, 3. Ed., 2007)

A Nordic standard protocol for detection and enumeration of thermotolerant Campylobacter in food has been elaborated (NMKL 119, 3. Ed., 2007). Performance and precision characteristics of this protocol were evaluated in a collaborative study with participation of 14 laboratories from seven European countries. The laboratories performed qualitative, semi-quantitative and quantitative analyses on samples of chicken meat, cut lettuce, and milk artificially inoculated with different concentrations including blank duplicates of one strain of Campylobacter coli (SLV-27 1) and one strain of Campylobacter jejuni (SLV-542). Expected concentrations (95% C.I.) (cfu g(-1) or ml(-1)) of both strains in matrices were 0.6-1.4 and 23-60 for qualitative detection, and 0.6-1.4; 23-60; and 420-1200 for semi-quantitative detection. For quantitative determination, the expected concentrations of C. jejuni/C. coli were 420-1200/580-1100; 2100-6000/6300-11,000; and 4100-11,000/53,000-97,000 cfu g(-1) or ml(-1). The qualitative and semi-quantitative techniques resulted in comparable detection. The overall specificity and sensitivity of the detection techniques was 98.6% (95% C.I.: 95.1-99.8%) and 82.8% (C.I.: 78.4-86.6%), respectively. The sensitivity was not influenced by food matrix (P=0.359), but was significantly lower for C. coli compared to C. jejuni (P= 0.007) and for concentrations below 1.4 cfu g(-1) (P<0.00 1). The detection techniques were therefore only considered satisfactory for detection of Campylobacter concentrations above approximately 25 cfu g(-1) for all matrices tested, which was supported by calculation of values for accordance, concordance, and concordance odds ratio. No statistical difference was found between enumerations obtained by the semi-quantitative and quantitative techniques for comparable concentrations of Campylobacter (420-1200 cfu g(-1) or cfu ml(-1)) (P= 0. 104). Both techniques underestimated concentrations of thermotolerant Campylobacter in milk. The semiquantitative technique estimated low inoculation levels of Campylobacter more correctly than the high inoculation levels. Counts obtained on the two selective plating media, Abeyta-Hunt-Bark agar added to it 0.1% triphenyl tetrazolium chloride and modified charcoal cephoperazone desoxycholate agar were not significantly different (P=0.143). Expressed as an absolute difference between log(10)-transformed results, the overall values for repeatability (r) and reproducibility (R) were r=log(10) 0.43 and R=log(10) 1.99, respectively. By omitting results from laboratories with high level of variability in results, R was reduced to log(10) 1.88. We suggest that the poor detection of low numbers, the underestimation in milk samples, and the large variation between laboratories can be explained by the general difficulties in handling Campylobacter. In conclusion, NMKL 119, 3. Ed., 2007, is regarded as an acceptable protocol for detection of thermotolerant Campylobacter at concentrations above 25 cfu g(-1) and also for enumeration of thermotolerant Campylobacter in chicken meat.
Prevalence of Salmonella in minced pork meat in supermarkets and butchers' shops in Denmark and dependence on retail supply chains

General information
Publication status: Published
Organisations: Division of Microbiology and Risk Assessment, National Food Institute, Department of Management Engineering
Contributors: Hansen, T. B., Shukri, N. M., Nielsen, N. L., Christensen, B. B., Aabo, S.
Publication date: 2007
Peer-reviewed: No
Event: Poster session presented at 7th International Symposium on Epidemiology & Control of Foodborne Pathogens in Pork, Verona, Italy.
Source: orbit
Source ID: 239521
Research output: Contribution to conference » Poster – Annual report year: 2007 » Research

Development of guidelines for regional food authorities to establish science based food safety programs

General information
Publication status: Published
Organisations: Division of Microbiology and Risk Assessment, National Food Institute
Contributors: Christensen, B. B., Hansen, T. B., Boysen, L., Rosenquist, H., Aabo, S., Andersen, J. K., Nielsen, N. L.
Publication date: 2006

Host publication information
Title of host publication: INTERREG III C RFO PromSTAP
Source: orbit
Source ID: 243346
Research output: Chapter in Book/Report/Conference proceeding » Article in proceedings – Annual report year: 2006 » Research

First year of promotion of Codex approved microbiological Food Safety Management tools

General information
Publication status: Published
Organisations: Division of Microbiology and Risk Assessment, National Food Institute
Contributors: Christensen, B. B., Hansen, T. B., Andersen, J. K., Aabo, S., Boysen, L., Nørrung, B., Rosenquist, H., Nielsen, N. L.
Publication date: 2006
Peer-reviewed: No
Event: Abstract from 1st Annual Congress Promoting the stable to table approach, Genoa, Italy.
Source: orbit
Source ID: 247915
Research output: Contribution to conference » Conference abstract for conference – Annual report year: 2006 » Research

Innovative systems in the field of food quality and safety. Development of a "Decision Support Tool" using minced pork meat as a model

General information
Publication status: Published
Organisations: Division of Microbiology and Risk Assessment, National Food Institute, University of Bonn, Wageningen University & Research
Contributors: Kreyenschmidt, J., Aabo, S., van Beek, P., Christensen, B. B., Hansen, T. B., Kampmann, Y., Kostov, L., Lettmann, T., Petersen, B.
Publication date: 2006
Promotion of Codex approved microbiological food safety management tools

General information
Publication status: Published
Organisations: Division of Microbiology and Risk Assessment, National Food Institute
Contributors: Christensen, B. B., Hansen, T. B., Boysen, L., Rosenquist, H., Aabo, S., Andersen, J. K., Nørrung, B., Nielsen, N. L.
Publication date: 2006

Host publication information
Title of host publication: INTERREG IIIC RFO PromSTAP
Source: orbit
Source ID: 243478
Research output: Chapter in Book/Report/Conference proceeding – Article in proceedings – Annual report year: 2006 – Research

SafeFood Guide: Development of guideline for regional food authorities to establish science based food safety programs

General information
Publication status: Published
Organisations: Division of Microbiology and Risk Assessment, National Food Institute
Contributors: Christensen, B. B., Hansen, T. B., Andersen, J. K., Aabo, S., Boysen, L., Rosenquist, H., Nielsen, N. L.
Publication date: 2006
Peer-reviewed: No
Event: Abstract from 1st Annual Congress Promoting the stable to table approach, Genoa, Italy.
Source: orbit
Source ID: 247949
Research output: Contribution to conference – Conference abstract for conference – Annual report year: 2006 – Research

Comparison of Methods for Assessing Reverse Osmosis Membrane Treatment of Shrimp Process Water

General information
Publication status: Published
Organisations: University of Copenhagen
Contributors: Casani, S., Hansen, T. B., Christensen, J., Knøchel, S.
Pages: 801-807
Publication date: 2005
Peer-reviewed: Yes

Publication information
Journal: Journal of Food Protection
Volume: 68
Issue number: 4
ISSN (Print): 0362-028X
Ratings:
Scopus rating (2005): SJR 1.098 SNIP 1.119
Web of Science (2005): Indexed yes
Original language: English
Source: orbit
Source ID: 257299

Growth of Heat-Treated Enterotoxin-Positive Clostridium perfringens and the Implications for Safe Cooling Rates

Clostridium perfringens 790-94 and 44071.C05 carrying a chromosomal and a plasmid cpe gene, respectively, were used to determine differences in heat resistance and growth characteristics between the genotypes. Heat inactivation experiments were conducted using an immersed coil apparatus. Spore germination, outgrowth, and lag phase, together named GOL time, as well as generation times were determined during constant temperatures in fluid thioglycollate (FTG) medium as well as in vacuum-packed, heat-treated minced turkey. GOL time and growth were also monitored during cooling scenarios from 65 to 10 degrees C for 3, 4, 5, 6, and 7 h in vacuum-packed, heat-treated minced turkey. Spores of strain 790-94 were approximately 10-fold more heat resistant at 85 degrees C than those of strain 44071.C05, and strain 790-94 also had a higher temperature growth range in FTG. The higher growth range for a chromosomal enterotoxin-producing CPE+ strain was confirmed using two other strains carrying a chromosomal (NCTC8239) and plasmid (945P) cpe gene. Moreover, strain 790-94 had shorter GOL times at 50 degrees C in turkey and approximately half the generation
time compared with strain 44071.C05 at temperatures greater than or equal to 45 degrees C in both FTG and turkey. Strain 790-94 increased with 0.3, 1.0, 1.7, and 2.0 logs, respectively, during cooling from 65 to 10 degrees C in 4, 5, 6, and 7 h, which was significantly higher than for strain 44071.C05. A maximum acceptable cooling time of 5 h between 65 and 10 degrees C is suggested.

General information
Publication status: Published
Organisations: University of Copenhagen
Contributors: Andersen, K. G., Hansen, T. B., Knøchel, S.
Pages: 83-89
Publication date: 2004
Peer-reviewed: Yes

Publication information
Journal: Journal of Food Protection
Volume: 67
Issue number: 1
ISSN (Print): 0362-028X
Ratings:
Scopus rating (2004): SJR 1.281 SNIP 1.391
Web of Science (2004): Indexed yes
Original language: English
Source: orbit
Source ID: 257298
Research output: Contribution to journal › Journal article – Annual report year: 2004 › Research › peer-review

Image analysis method for evaluation of specific and non-specific hand contamination
Keyword: palm imprint method, hand washing, fingertip dipping method, cloth-swab method, Listeria, Enterobacteriaceae

General information
Publication status: Published
Organisations: University of Copenhagen
Contributors: Hansen, T. B., Knøchel, S.
Pages: 483-494
Publication date: 2003
Peer-reviewed: Yes

Publication information
Journal: Journal of Applied Microbiology
Volume: 94
ISSN (Print): 1364-5072
Ratings:
Web of Science (2003): Indexed yes
Original language: English
Source: orbit
Source ID: 257295
Research output: Contribution to journal › Journal article – Annual report year: 2003 › Research › peer-review