

Quantitative Risk Assessment of *Listeria monocytogenes* in Ready-to-eat Fish Products

Petra Pasonen, Jukka Ranta and Pirkko Tuominen

Finnish Food Safety Authority Evira, Risk Assessment Research Unit, Helsinki, Finland

firstname.lastname@evira.fi

Purpose of the Study

L. monocytogenes (LMO) is a common foodborne bacterium capable of causing severe disease especially in persons with impaired immunity, including elderly. In Finland, RTE fish products are considered one of the most likely foods to be contaminated with LMO. As the population is aging in industrial countries, listeriosis is becoming an emerging concern and therefore LMO risk assessment is needed to evaluate the best risk management options. In this study, a LMO risk assessment was carried out for cold smoked (CSS) and salt cured salmon (SCS) to assess the risk for two populations: elderly (≥ 65 years) and working-aged (25–64 years, denoted as reference). Bayesian statistics was utilized as a modelling tool as it features many advantages: utilizing the whole data, handling of censored values, flexibility, and taking uncertainty into account.

Methods

This LMO risk assessment covers the time period from retail to consumption. Data from national LMO surveys ($n=1,083$) were utilized for prevalence-concentration model for CSS and SCS. The distribution from the concentration model was used as input to a growth model [1, 2] that predicted the effect of temperature (3, 7, or 10°C) during a 10 day storage period to the levels of LMO in CSS/SCS. The results from national Findiet 2007 study ($n=2,038$) were used to predict the consumption of CSC/SSC for the two populations. These two models were combined in exposure assessment model and the resulting exposure distributions were fed to the exponential dose-response model built by WHO/FAO [3]. (Figure 1) The modelling was carried out using R and OpenBUGS software.

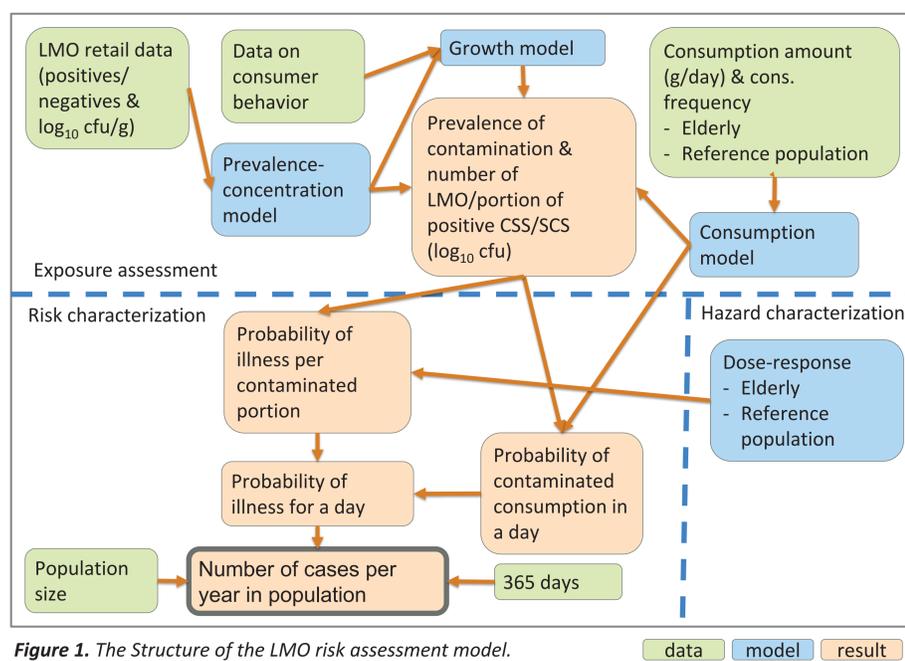


Figure 1. The Structure of the LMO risk assessment model.

Results

As most of the measured LMO concentrations were below the detection limit, the predicted concentrations were accordingly low. The median value was only 0.5 and the highest value 5 log₁₀ cfu/g. When the predicted LMO concentration is combined to the predicted consumption of CSS/SCS (mean 85 g and median 70 g for elderly, mean 70 g and median 60 g for reference group), no listeriosis cases were predicted for either populations. However, the exposure varied greatly among the predicted scenario. A mean dose per portion of CSS/SCS was 2 log₁₀ cfu when no growth was predicted. Storage in the highest temperature used (10°C) and the longest period (10 d) could elevate the mean dose to 7 log₁₀ cfu (Figure 2). The elderly population had a higher probability to catch listeriosis than the working-aged reference population (Figure 3).

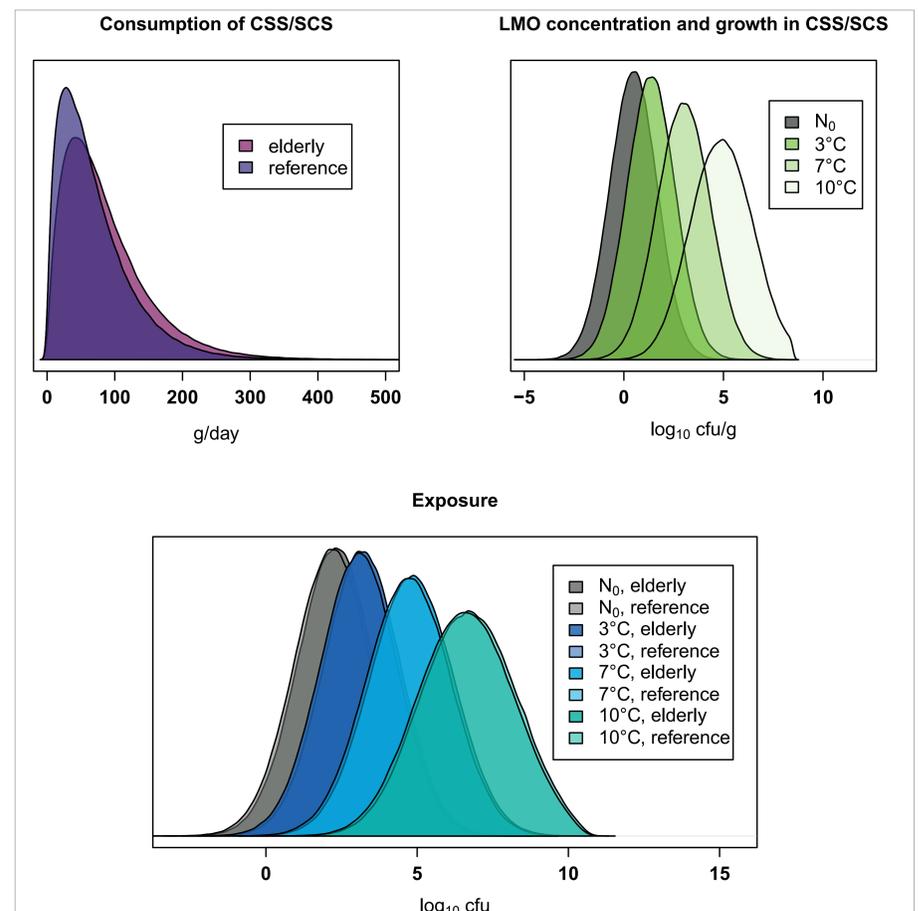


Figure 2. Predicted consumption of CSS/SCS, the effect of temperature on LMO concentration and the corresponding exposures.

Conclusions

Temperature abuse and a long storage period increased predicted annual listeriosis cases outstandingly. The results show that elderly are at higher risk than working-age population even though the exposures were at a similar level. Therefore, risk management options should be targeted to reduce food mishandlings in the elderly population.



Figure 3. Predicted listeriosis cases according to different storage scenarios..

Acknowledgments

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References

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