



POSTER

A BAYESIAN APPROACH TO LISTERIA MONOCYTOGENES RISK ASSESSMENT AND SAMPLING PLAN OPTIMIZATION IN OFFICIAL CONTROLS

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Introduction and Objective. *Listeria monocytogenes* (Lm) is a major foodborne pathogen responsible for listeriosis, a serious invasive infection with case-fatality rates exceeding 20% particularly among vulnerable populations. Official food control programmes play a key role in monitoring the occurrence of Lm in ready-to-eat (RTE) foods, supporting risk assessment and risk management activities. This study aimed to estimate the prevalence of Lm in four RTE food categories using a Bayesian framework applied to the official control data collected in Marche Region, Italy, between 2014 and 2025.

Methods. Samples collected by Public Health Services within the official food control programme were analysed by accredited Laboratories of IZSUM according to the microbiological criteria established by Regulation (EC) No. 2073/2005. Data extracted from the laboratory database, included 1,788 samples (five sampling units per sample), from four RTE food categories: meat preparations (n=20), raw cured meats (n=537), cooked cured meats (n=255) and deli products (n=976). Bayesian prevalence estimates were obtained under two prior assumptions: a non-informative Jeffreys prior [Beta (0.5, 0.5)] and informative category-specific prior derived from EFSA One Health Zoonoses Reports (2019-2023). Results were summarized by posterior mean of not compliant results, standard deviations, and 95% Highest Density Intervals (HDIs). Evidence supporting predefined prevalence thresholds was assessed through Bayes Factors (BF₁₀). Future observations were estimated using posterior predictive distributions.

Results. Raw cured meats showed the highest prevalence,

with a posterior mean prevalence of 14.5-14.6% (95% HDI: 11.7-17.6%), largely unaffected by prior specification because of the substantial sample size. Temporal analysis revealed recurring prevalence peaks in 2014, 2016, 2018, and 2023 with the highest annual posterior mean prevalence was observed in that year. Cooked cured meats showed a posterior mean of 6.2-6.4% (95% HDI: 3.5-9.5%) and occasional episodes of very high contamination levels (> 1,500,000 CFU/g in 2018) indicating potential weaknesses in processing or storage conditions. Meat preparations exhibited a comparable posterior prevalence estimate (13.5-16.7%) but substantial uncertainty owing to the limited sample size (95% HDI approximately 3-32%). Deli products showed the lowest prevalence (posterior mean 1.9%; 95% HDI: 1.1-2.8%); however, sporadic detections exceeding 1,000 CFU/g, suggest that the risk for susceptible consumers cannot be disregarded. Bayesian hypothesis testing provided decisive evidence (BF₁₀ > 100) that prevalence exceeds 5% in raw cured meats and remained below this threshold in deli products. Posterior predictive modelling estimated 6-7 positive samples per annual batch of 45 raw cured meat samples (95% predictive interval: 2-12).

Conclusions. The Bayesian approach provided a robust and operationally relevant quantification of Lm prevalence in RTE foods under official control. The findings support intensified official control measures and corrective actions for raw cured meats, increased sampling efforts for meat preparations, continued surveillance of deli products with particular attention to high-level contamination events and the potential extension of Bayesian analytical frameworks to other food categories and pathogens within regional food safety monitoring programmes.