Quantitative Microbiological Risk Assessment of Nontyphoidal *Salmonella* in Ground Pork from China and Broiler Chickens from Canada

蕭淮安 (5128)

2022/10/19

Outline

1. Introduction
2. Quantitative microbiological risk assessment of nontyphoidal *Salmonella* in ground pork in households in Chengdu
3. A farm-to-fork quantitative risk assessment model for *Salmonella* Heidelberg resistant to third-generation cephalosporins in broiler chickens in Canada
4. Conclusion

Abstract

Foodborne disease caused by nontyphoidal *Salmonella* (NTS) is one of the most important food safety issues worldwide. *Salmonella* Heidelberg resistant to ceftiofur (a third-generation cephalosporin antimicrobial agent) posed a risk to public health in Canada. The objectives of this study were to carry out microbial monitoring on the prevalence of NTS in commercial ground pork and *S.* Heidelberg in broiler chicken, investigate consumption patterns, and conduct a quantitative microbiological risk assessment (QMRA). The results showed that the prevalence of NTS in ground pork purchased in Chengdu was 69.64% (95% confidence interval [CI], 60.2–78.0), with a mean contamination level of −0.164 log CFU/g. After general cooking, NTS in ground pork could be eliminated (contamination level of zero). The estimated probability of causing salmonellosis per day was 9.43E-06 (95% CI: 8.82E-06–1.00E-05), while the estimated salmonellosis cases per million people per year were 3442 (95% CI: 3218–3666). The risk in Canada was reduced by 90% or 20% when two separate scenarios designed to capture the effect of withdrawing preventive ceftiofur use from poultry production were simulated using different approaches; A 50% reduction in the probability of human prior exposure to antimicrobials, which has a selective and competitive effect for *Salmonella* spp. following ingestion of contaminated products, reduced the risk by 65%. Other promising measures that could be considered for further risk management included improved cleaning and disinfection between broiler flocks on farm (risk reduction by 26%), exclusive use of air chilling (risk reduction by 34%), and the improvement of meat storage and preparation conditions, e.g., no temperature abuse at retail (risk reduction by 88%). These findings showed the importance of a structured approach to assessing and potentially implementing effective interventions to reduce the risk associated with ceftiofur-resistant *S.* Heidelberg at different steps along the agri-food chain.

References

Akil, L., & Ahmad, H. A. (2019). Quantitative risk assessment model of human *salmonellosis* resulting from consumption of broiler chicken. *Diseases*, *7*, 19.

Bai, L., Wang, J., Sun, H., Wang, Y., Wang, Y., Wang, Q., & Liu, Z. (2022). Quantitative microbiological risk assessment of nontyphoidal *Salmonella* in ground pork in households in Chengdu, China. *Risk Analysis*, *00*, 1-18.

Butler, A. J., Thomas, M. K., & Pintar, K. D. (2015). Expert elicitation as a means to attribute 28 enteric pathogens to foodborne, waterborne, animal contact, and person-to-person transmission routes in Canada. *Foodborne pathogens and disease*, *12*, 335-344.

Collineau, L., Chapman, B., Bao, X., Sivapathasundaram, B., Carson, C. A., Fazil, A., Reid-Smith, R. J., Smith, B. A. (2020). A farm-to-fork quantitative risk assessment model for *Salmonella* Heidelberg resistant to third-generation cephalosporins in broiler chickens in Canada. *International Journal of Food Microbiology*, *330*, 108559.

Davidson, V. J., Ravel, A., Nguyen, T. N., Fazil, A., & Ruzante, J. M. (2011). Food-specific attribution of selected gastrointestinal illnesses: estimates from a Canadian expert elicitation survey. *Foodborne pathogens and disease*, *8*, 983-995.

European Centre for Disease Prevention and Control. (2015). The European Union summary report on trends and sources of zoonoses, zoonotic agents and food-borne outbreaks in 2014. *EFSA Journal*, *13*, 4329.

Government of Canada. (2018). Canadian integrated program for antimicrobial resistance surveillance (CIPARS) 2016 annual report. *Guelph, Ontario*.

Haddad, N., Johnson, N., Kathariou, S., Métris, A., Phister, T., Pielaat, A., Wells-Bennik, M. H. J., Zwietering, M. H. (2018). Next generation microbiological risk assessment—potential of omics data for hazard characterisation. *International Journal of Food Microbiology*, *287*, 28-39.

Havelaar, A. H., Kirk, M. D., Torgerson, P. R., Gibb, H. J., Hald, T., Lake, R. J., Praet, N., Bellinger, D. C., de Silva, N. R., Gargouri, N., Speybroeck, N., Cawthorne, A., Mathers, C., Stein, C., Angulo, F. J., & Devleesschauwer, B. (2015). World Health Organization global estimates and regional comparisons of the burden of foodborne disease in 2010. *PLoS Medicine*, *12*, e1001923.

Juneja, V. K., Melendres, M. V., Huang, L., Gumudavelli, V., Subbiah, J., & Thippareddi, H. (2007). Modeling the effect of temperature on growth of *Salmonella* in chicken. *Food microbiology*, *24*, 328-335.

Nauta, M. J., Jacobs-Reitsma, W. F., & Havelaar, A. H. (2007). A risk assessment model for *Campylobacter* in broiler meat. *Risk Analysis*, *27*, 845-861.