IAFP Latino 2024
Simpósio Latinoamericano em Segurança dos Alimentos
Santos - SP - Brasil
11 a 14 Nov, 2024

The infection risks from consumption of norovirus-contaminated tomatoes to individuals and populations – application of a novel risk assessment model to support the Codex Alimentarius

Juan S. Leon[1,2,3], Elizabeth T. Sajewski[3], Ben A. Lopman[2], Julia S. Sobolik[3]

[1.] Emory University, Hubert Department of Global Health, Rollins School of Public Health, Atlanta, Georgia, U.S.A.
[2.] Emory University, Department of Epidemiology, Rollins School of Public Health, Atlanta, Georgia, USA
[3.] Emory University, Gangarosa Department of Environmental Health, Rollins School of Public Health, Atlanta, Georgia, USA

Norovirus is a leading cause of foodborne illness worldwide. In 2012, the Codex Alimentarius recommended practices and processes to reduce the risk of noroviruses in foods. To inform updates to the Codex Alimentarius, the Food and Agriculture Organization of the United Nations (FAO) and the World Health Organization (WHO) are currently developing scientific guidance to reduce viral risks on foods. This scientific guidance includes recommendations of risk assessment models of viruses on foods for wide use among Member countries, including in Latin America. Thus, our goal was to develop an integrated risk assessment model for noroviruses on fruits and vegetables that could estimate both the individual- and population-level risks and support the efforts of FAO/WHO for the Codex Alimentarius. We demonstrated the use of this model to quantify the magnitude of disease risk to both individual consumers and to a population of consumers ingesting contaminated tomatoes with norovirus. We developed a quantitative microbial risk assessment (QMRA)-linked infectious disease transmission (IDT) model to 1) characterize individual risk from consumption of empirically-sampled, norovirus-contaminated tomatoes, and 2) simulate norovirus cases in a population from a norovirus-tomato seeding event. Sequence-confirmed norovirus GII.6 strains were isolated from tomatoes collected on Mexican farms and tomato norovirus concentration was quantified using digital RT-PCR. We used a QMRA model to estimate infection risks (10,000 iterations, mc2d package, 1:100 infectious ratio) based on empirically-sampled concentration data and age-stratified tomato consumption rates. Median infection risks varied by age, with the lowest risk (1.9×10^{-4} per day) among children (<6 years): and the highest risk ($1 .4 \times 10^{-3}$ per day) among adults (21 to <60 years). These risks were integrated into the IDT model (N=100,000; 50% of population exposed to tomatoes) to simulate a one-time norovirus seeding event. Using the IDT model, a single outbreak from tomato consumption alone lasted four days with a cumulative incidence of 16 cases: 11 symptomatic, 5 asymptomatic. When simulating primary cases resulting from tomato consumption and secondary cases from contact with tomato-infected primary cases, the outbreak lasted 17 days with a cumulative incidence of 42 cases: 29 symptomatic; 13 asymptomatic. We compare these results with those of published reports in Latin American countries. This study underscores the utility of integrated risk assessment models to advance the precision of produce risk assessment and to inform effective mitigation strategies. Further, this study provides a novel risk assessment model useful for FAO/WHO's recommendations to strengthen the Codex Alimentarius and reduce the risk of viruses in foods among Member countries, including in Latin America.

Agradecimentos: This work was partially supported by T32 grant 2T32ES012870-16 from the National Institutes of Health (J.S.S.), grants 2019-67017-29642, 2023-08756 (J.S.L.) and 2020-67034-31728 (J.S.S.) from the National Institute of Food and Agriculture at the U.S. Department of Agriculture, grants R01 GM124280 and R01 GM124280-03S1 (B.A.L.) from the National Institute of General Medical Sciences, grant T32AI138952 (E.T.S.) from the National Institute of Allergy and Infectious Diseases of the National Institutes of Health, and funds from Emory University and the Infectious Disease Across Scales Training Program (E.T.S.). The contents of this paper are solely the responsibility of the authors and do not necessarily represent the official views of the National Institutes of Health, or the U.S. Department of Agriculture.