news digest #021

Fast source tracking of *S. aureus* food contamination

Author: Matteo Viganó, Food & Industry Microbiology, Bruker Microbiology & Infection Diagnostics

Food can become contaminated during production or handling, such as in restaurants, hospitals, and nursing homes, and can spread rapidly if the source isn't pinpointed. Tracking down the source requires technologies that are easy to use, fast, and cost-effective. While many traditional methods like PFGE and MLST, as well as newer ones like WGS, lack these qualities, the IR Biotyper® stands out by offering them along with high accuracy.

Despite advancements in food quality control technologies, a high number of food contamination cases occur every year, especially with microbiological origin. The presence of these pathogens or their produced toxins in food can lead to severe health consequences, often resulting in outbreaks affecting multiple individuals who have consumed the contaminated food. These foodborne epidemics pose a substantial threat to public health and can have significant economic repercussions.

In Europe alone, statistics from 2019 reveal a staggering 5,175 foodborne epidemics, involving 49,463 cases of illness, 3,859 hospitalizations, and 60 fatalities.[1] Among the various pathogens responsible, *Salmonella* emerges as the most prevalent, accounting for almost a fifth (19.3%; 773 cases) of the total cases. The implications of such outbreaks extend beyond immediate health concerns, impacting both food producers and public health agencies also economically.

To effectively manage these crises, swift intervention is crucial. Identifying the pathogen and tracing the origin of the epidemic are essential steps in preventing further spread. However, despite existing traceability laws, pinpointing the exact source of contamination can be challenging. Incidents of food contamination can occur at various stages of the food supply chain, from primary production to processing and even in public or domestic settings.[2]

In response to these challenges, laboratories have embraced advanced technologies to expedite pathogen identification and especially typing. Typing systems play a vital role in epidemic investigations by confirming transmission patterns and identifying the sources of contamination. Traditional methods such as serotyping and molecular approaches like pulsed-field gel electrophoresis (PFGE) and multi-locus sequence typing (MLST) have been historically employed for bacterial typing. However, the advent of whole-genome sequencing (WGS) has revolutionized microbial pathogen surveillance and outbreak investigation, offering unparalleled discriminatory power. Despite the benefits of WGS, challenges such as the need for specialized equipment and personnel, prolonged turnaround times, and high costs persist.[3]

Recently, a new automated typing system based on Fourier-transform infrared spectroscopy (FT-IR), known as the IR Biotyper®, has emerged as a promising alternative. This system not only matches the typing and discriminatory capabilities of genome-based methods but also offers simplicity, rapid results, and cost-effectiveness.[4] A notable example of the IR Biotyper's efficacy can be seen in the investigation of a *Staphylococcus* food poisoning outbreak at a nursing home in Italy.[5] *Staphylococcus aureus*, a common bacterium found on the skin, can contaminate food if proper hygiene practices are not followed. The toxin produced by this bacterium causes rapid-onset food poisoning, characterized by symptoms such as nausea, vomiting, and abdominal cramps. In the aforementioned study, both the IR Biotyper and WGS were utilized for typing and characterization, yielding comparable results.

The identification of chicken salad as the likely source of contamination underscores the importance of rapid and accurate typing methods in outbreak investigations. Despite the wealth of information provided by WGS, FT-IR spectroscopy proves to be a valuable tool due to its speed, ease-of-use and cost-effectiveness, making it ideal for real-time surveillance.

In conclusion, the persistent threat of foodborne epidemics necessitates the continuous development and adoption of advanced technologies for pathogen detection and typing. The emergence of FT-IR spectroscopy as a viable alternative to traditional typing methods offers a promising solution to the challenges posed by food contamination outbreaks. By facilitating rapid response and effective intervention, this technology can play a crucial role in safeguarding public health and mitigating economic losses associated with foodborne illnesses.

References
1 EFSA and ECDC (European Food Safety Authority and European Centre for Disease Prevention and Control), 2021. The European Union One Health 2019 Zoonoses Report. EFSA Journal 2021;19(2):6406, 286 pp. https://doi.org/10.2903/j.efsa.2021.6406
2 https://www.health.state.mn.us/diseases/foodborne/basics.html
3 B.J. Parcell, S.H. Gillespie, K.A. Pettigrew, M.T.G. Holden, Clinical perspectives in integrating whole-genome sequencing into the investigation of healthcare and public health outbreaks - hype or help?, Journal of Hospital Infection, Volume 109, 2021, Pages 1-9, ISSN 0195-6701, https://doi.org/10.1016/j.jhin.2020.11.001
4 Hu Y, Zhou H, Lu J, Sun Q, Liu C, Zeng Y, Zhang R. Evaluation of the IR Biotyper for *Klebsiella pneumoniae* typing and its potentials in hospital hygiene management. Microb Biotechnol. 2021 Jul;14(4):1343-1352. https://doi.org/10.1111/1751-7915.13709
5 Savini, F., Romano, A., Giacometti, F., Indio, V., Pitti, M., Decastelli, L., Devalle, P. L., Gorrasi, I. S. R., Miaglia, S., & Serraino, A. (2023). Investigation of a *Staphylococcus aureus* sequence type 72 food poisoning outbreak associated with food-handler contamination in Italy. Zoonoses and Public Health, 70, 411–419. https://doi.org/10.1111/zph.13046

Not for use in clinical diagnostic procedures.
Please contact your local representative for availability in your country.

Online information
bruker.com/microbiology

Bruker Daltonics GmbH and Co. KG
Bremen · Germany
Phone +49 (0)421-2205-0

info.md@bruker.com

Bruker Scientific LLC
Billerica, MA · USA
Phone +1 (978) 663-3660