



A new take on Staphylococcal Food Poisoning

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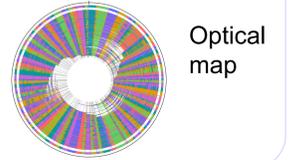
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Background

Ingestion of staphylococcal enterotoxins (SEs) leads to Staphylococcal Food Poisoning (SFP), the most prevalent food-borne intoxication worldwide

Sequencing approaches were used to extend the limited knowledge on the genomic background of SEs.

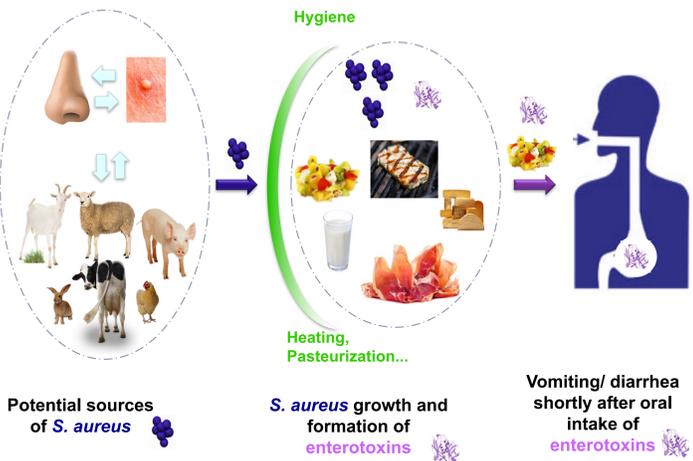
=> We detected several **new SE gene variants** and a **novel *seb+* pathogenicity island** in an outbreak strain.



Genomic background

Source attribution studies

DNA microarray profiling was used for source attribution using 1000 isolates from different sources, including SFP outbreaks.



Infections in humans



Outbreak strains

=> Contamination of food by **food handlers** is the most common source of SFP strains. **Bovine mastitis strains of genotype B** can cause outbreaks due to raw milk products.

New SEs cause SFP

Using outbreak investigations, we were able to provide evidence confirming that **newly described SEs** encoded by the enterotoxin gene cluster **egc** can cause SFP.

Objectives

In this study, we aimed to...

- 1) Identify the genomic background of SFP
- 2) Identify the most common sources of SFP
- 3) Investigate the role of newly described SEs in outbreaks
- 4) Examine enterotoxin expression and regulation under food-related stress conditions

SE expression under food-related stress

Expression was quantified under food-related stress conditions in multiple wild type and isogenic regulatory knockout strains using transcriptional fusions, a quantitative Real-Time approach and an ELISA assay. A ham model was also included.

=> Food-related **stress can inhibit and boost enterotoxin expression** depending on the stressor or strain. The same variation was seen for the effect of the loss of regulatory elements.

=> The production of staphylococcal enterotoxins cannot be reliably predicted based exclusively on **viable cell counts**. This is of particular relevance in view of current legislation using *S. aureus* viable cell counts to determine the safety of food products.

NaCl

Reduced enterotoxin expression

Significant reduction in *seb* expression ↓
Trend towards lower *sed* expression ↘



Glucose

Reduced enterotoxin expression

Significant reduction in *seb* expression ↓
Trend towards lower *sed* expression ↘



Nitrite

Reduced or enhanced enterotoxin expression

Significant reduction in *seb* expression ↓
Increase in *sed* expression in some strains ↑



Lactic acid

Reduced enterotoxin expression

Increase in *seb* expression in some strains ↑
Trend towards higher *sed* expression ↗



Conclusions

- 1) We detected several **new SE gene variants** and a **novel *seb+* pathogenicity island** in an outbreak strain.
- 2) Colonized/ infected **food handlers** are the most common source of SFP outbreak strains. Bovine mastitis strains of **genotype B** can lead to outbreaks linked to raw milk products.
- 3) Using the findings of outbreak and product related studies, we were able to show that **newly-described SEs can cause outbreaks** of SFP.
- 4) Food-related **stress can inhibit and boost enterotoxin expression** depending on the stressor or strain. The production of staphylococcal enterotoxins cannot be reliably predicted based exclusively on viable cell counts.

