

Identification of the presence of Staphylococcal enterotoxin A in positive *S. aureus* samples

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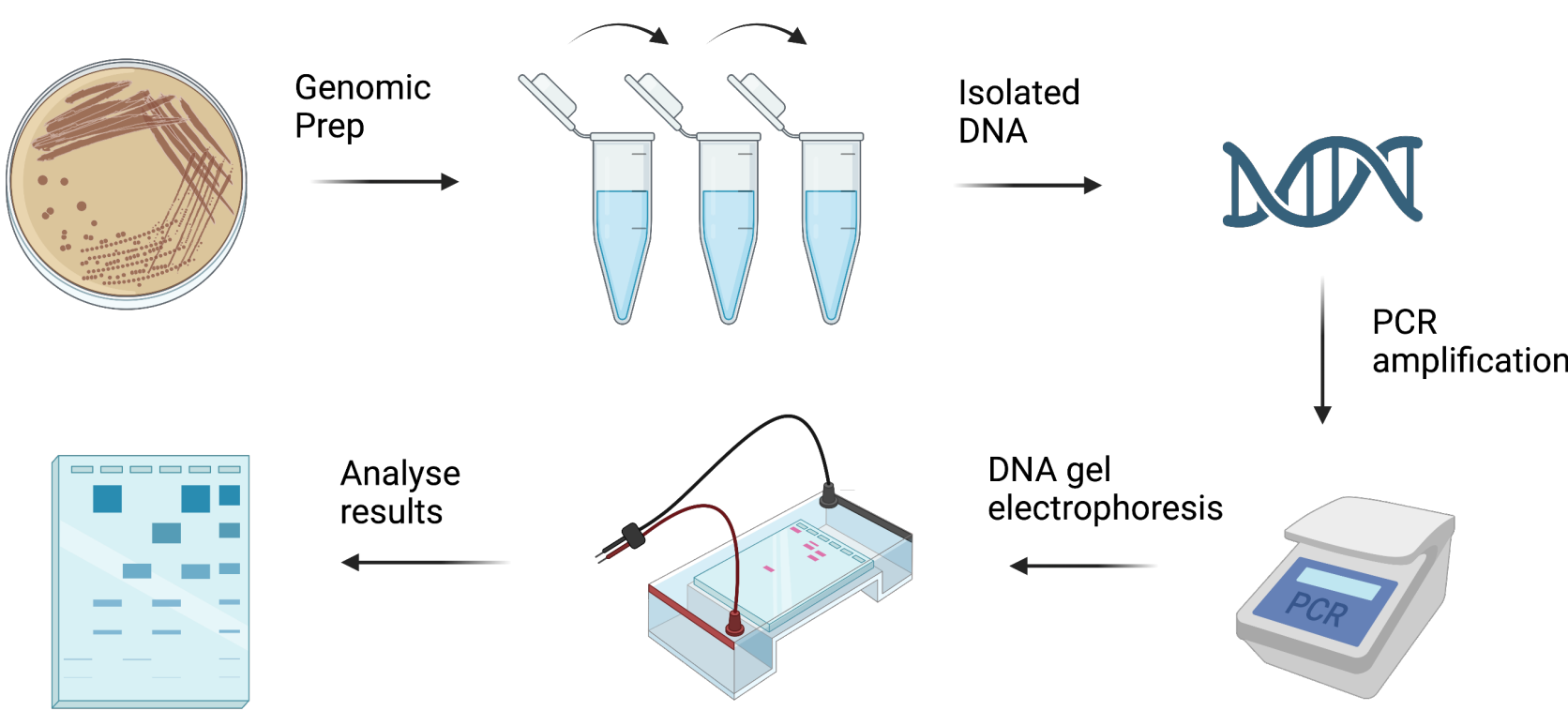
Abstract

*Staphylococcus aureus* is a commensal bacterium found in the nares, skin, and mucosal membranes. In most cases, it causes no harm, but there are instances where it can become pathogenic and produce toxins that have superantigenic activity. Staphylococcal enterotoxin A (SEA), when ingested, is the causative agent responsible for classical food poisoning symptoms such as emesis, nausea, and others. When SEA enters the bloodstream, it can cause toxic shock due to mass T cell proliferation and cytokine storm. In order to determine if positive *Staphylococcus aureus* samples contain the SEA gene, DNA was purified and amplified using PCR. DNA gel electrophoresis was conducted to analyze whether positive samples contain the SEA gene. We found that out of 56 samples tested only 0.07% of the samples had SEA present.

Study Overview

Number of swabs	Number of swabs processed	Number of swabs positive for <i>S. aureus</i>	Carriage rate
1605	1432	361	25.2

- ☐ *S. aureus* samples were grown on TSA plates.
- ☐ Genomic preparation was done to isolate *S. aureus* DNA
- ☐ PCR was performed to amplify the purified SEA gene
- ☐ DNA gel electrophoresis was conducted to confirm whether the SEA toxin is present in that strain.

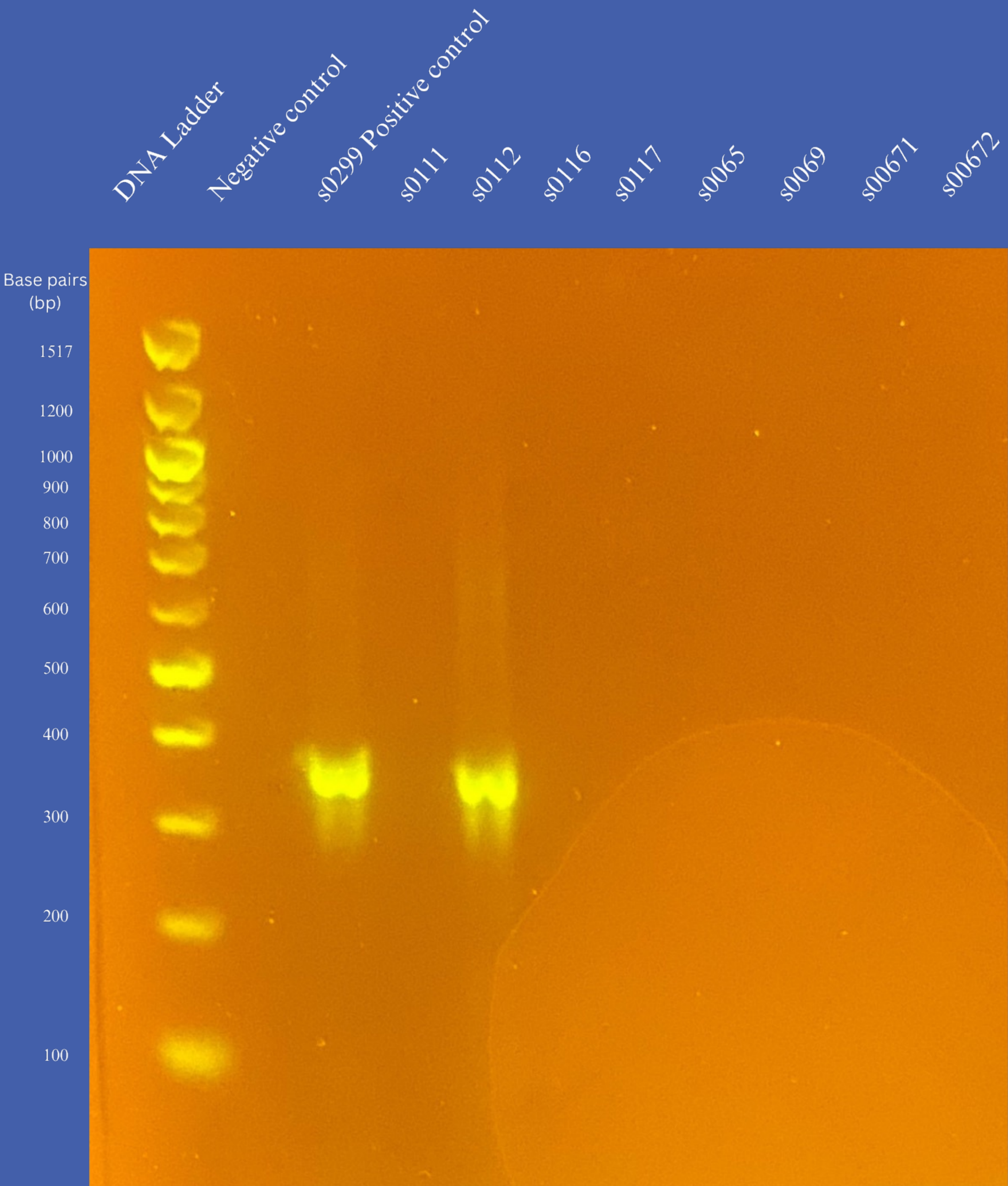


Acknowledgment

Special thanks to Dr. Patrick Schlievert (University of Iowa) for helpful conversations. This research was partially funded by several CSP Faculty Development Grants. This work has IRB approval from CSP (studies 2016\_42 & 2018\_37).

A partnership with the Minnesota Department of Health Infectious Disease Laboratory allowed for whole genome sequencing of an initial subset of *S. aureus* strains from the campus study.

The presence of Staphylococcal enterotoxin A expression is 0.07% in the 56 samples tested



Detection of SEA Gene in Positive *S. aureus* Samples through PCR amplification and DNA gel electrophoresis : After PCR amplification to determine the presence of the SEA gene in the selected *S. aureus* samples, DNA gel electrophoresis was performed to identify the gene. The expected band size is 400 bp

SEA as a superantigen

- ☐ Normally, the T cell receptor on the T cell would interact with MHC II present on an antigen-presenting cell. If the antigen presented to the T cell is specific to that antigen and recognized as foreign, downstream activation would occur, leading to T cell activation and specification to that specific antigen.(2)
- ☐ SEA, as a superantigen stimulates T cell proliferation by joining together major histocompatibility complex class II and antigen-presenting cells.(2)
- ☐ Once SEA causes binding between the antigen-presenting cell and T cell, this leads to T cell activation and mass T cell proliferation that is not specific to the SEA toxin. As T cells continue to proliferate and secrete cytokines, too much cytokine buildup can lead to toxic shock.

SEA as an enterotoxin

- ☐ SEA is an enterotoxin, meaning that the toxin affects the gastrointestinal tract and causes classical food poisoning symptoms.
- ☐ SEA toxin targets mast cells in the submucosa, especially in the jejunum and ileum, causing mast cell degranulation. (3)
- ☐ As a result of mast cell degranulation, histamine is released, which stimulates the vagus nerve and triggers an emetic response. (3)

Why is SEA toxin significant?

- ☐One of the most common places *S. aureus* can be found is in the epidermis layer of the skin.
- ☐Without proper hand hygiene, especially during food preparation, people who have *S. aureus* present as a commensal bacterium can contaminate food.
- ☐When food is contaminated with *S. aureus* the bacterium multiply and produce toxins that cause *S. aureus* related illnesses.
- ☐Foods that are most at risk include sandwiches, sliced meat, pastries, and so on (4).

Results

Sample number	s0111	s0112	s0116	s0117	s0065	s0069	s00671	s00672
Results	-	+	-	-	-	-	-	-

References

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4.Staphylococcal (Staph) Food Poisoning. *Center for Disease Control*. 1-2 (2023).