REVIEW ARTICLE

RFP Indian Journal of Hospital Infection
Volume 7 Number 2, July - December 2025

Staphylococcus aureus Food Poisoning: An Overview

Ananya Paul[1], Sayan Bhattacharyya[2], Shibani Lahiri[3]

HOW TO CITE THIS ARTICLE:

Ananya Paul, Sayan Bhattacharyya, Shibani Lahiri. *Staphylococcus aureus* Food Poisoning: An Overview. RFP Ind. Jr. Hosp. Inf., 2025; 7(2): 43-47.

ABSTRACT

Foodborne infections are becoming increasingly common nowadays due to increased urbanization and other factors. One of the major microorganisms causing foodborne infections is *Staphylococcus aureus*. It is a Gram positive pathogen causing a plethora of infections in man, but can also act as commensal. It is also a common commensal microorganism of skin and external nose in man in about 20-50% cases. Staphylococci are truly ubiquitous in the environment and their existence can be traced in the air, dust, sewage, water, various environmental surfaces, humans and animals. It enters the food chain via street food or unclean hands. The heat stable enterotoxin is responsible for food poisoning due to *Staphylococcus aureus*. Manifestations of food poisoning due to Staphylococci are vomiting and diarrhoea. Specimens or diagnosis include food and stool but colony count is important. Studying these aspects forms a very important component of public health. This review presents available information regarding this bacterial pathogen in causing food poisoning cases.

KEYWORDS

• Staphylococcus • Enterotoxin • Food Poisoning

AUTHOR'S AFFILIATION:

[1] Student, Department of Applied Nutrition, All India Institute of Hygiene and Public Health, Kolkata, West Bengal India.

[2] Professor, Department of Microbiology, All India Institute of Hygiene and Public Health, Kolkata, West Bengal, India.

[3] Director Professor and Head, Department of Biochemistry and Nutrition, All India Institute of Hygiene and Public Health, Kolkata, West Bengal, India.

CORRESPONDING AUTHOR:

Sayan Bhattacharyya, Professor, Department of Microbiology, All India Institute of Hygiene and Public Health, Kolkata, West Bengal, India.

E-mail: sayantheboss@yahoo.co.in

➢ **Received:** 15.09.2025 ➢ **Accepted:** 21.11.2025

INTRODUCTION

Foodborne illnesses remain a major global health concern, with millions of cases reported annually. Among the bacterial causes, *Staphylococcus aureus* holds a prominent position due to its ability to produce the heat-stable enterotoxins in food. Staphylococcal food poisoning (SFP) is one of the most common foodborne intoxications worldwide and is notable for its rapid onset of symptoms, short duration, and frequent outbreaks linked to improper food handling.

This article provides a holistic overview of the bacterium, its toxins, sources of contamination, epidemiology, clinical features, diagnosis, treatment, and prevention strategies.

The Organism: *Staphylococcus aureus*

Staphylococcus aureus is a Gram-positive, non-motile, non-spore-forming coccus that forms grape-like clusters when viewed microscopically. It is facultatively anaerobic and catalase-positive. Staphylococci are ubiquitous in the environment and can be found in the air, dust, sewage, water, environmental surfaces, humans and animals. While it is an opportunistic pathogen associated with skin and soft tissue infections, pneumonia, endocarditis, and sepsis, it is also a leading cause of foodborne intoxications.

A significant trait of S. aureus in foodborne disease is its ability to produce staphylococcal enterotoxins (SEs). To date, more than 30 different SEs and SE-like toxins have been described, with SEA, SEB, SEC, SED, and SEE being the most common causes of food poisoning. These toxins are heat-stable and can resist proteolytic enzymes such as pepsin and trypsin, enabling them to retain biological activity even after cooking or gastrointestinal passage.

EPIDEMIOLOGY

S. aureus accounts for up to one-third of foodborne gastrointestinal illnesses.[1] It can occur in hospitalized patient also.

Staphylococcal food poisoning (SFP) occurs worldwide and is often underreported because of its short duration and self-limiting nature. Outbreaks are typically associated with improperly handled food. According to the World Health Organization (WHO), SFP ranks among the top causes of foodborne outbreaks globally.

Reservoirs: *S. aureus* is part of the normal flora of the skin and nasal cavity in 20–50% of healthy individuals.[2] Food handlers are therefore an important source of contamination.

High-risk foods: Dairy products, bakery items (cream-filled pastries), cooked meat and meat products, poultry, egg products, and salads with mayonnaise are frequent vehicles.[3] Foods that require manual handling and are stored at ambient temperatures are particularly risky.

Even baked desserts also, such as cream-filled pastries, cream pies, and chocolate éclairs, potatoes, tuna, chicken, turkey, ready-to-eat dishes, milk, and milk products are regularly contaminated by Staphylococcus enterotoxins (SEs).

Incubation period: Symptoms of Staphylococcal food poisoning appear rapidly, usually within 1–6 hours of ingestion, making it one of the fastest-onset foodborne illnesses.[4]

PATHOGENESIS

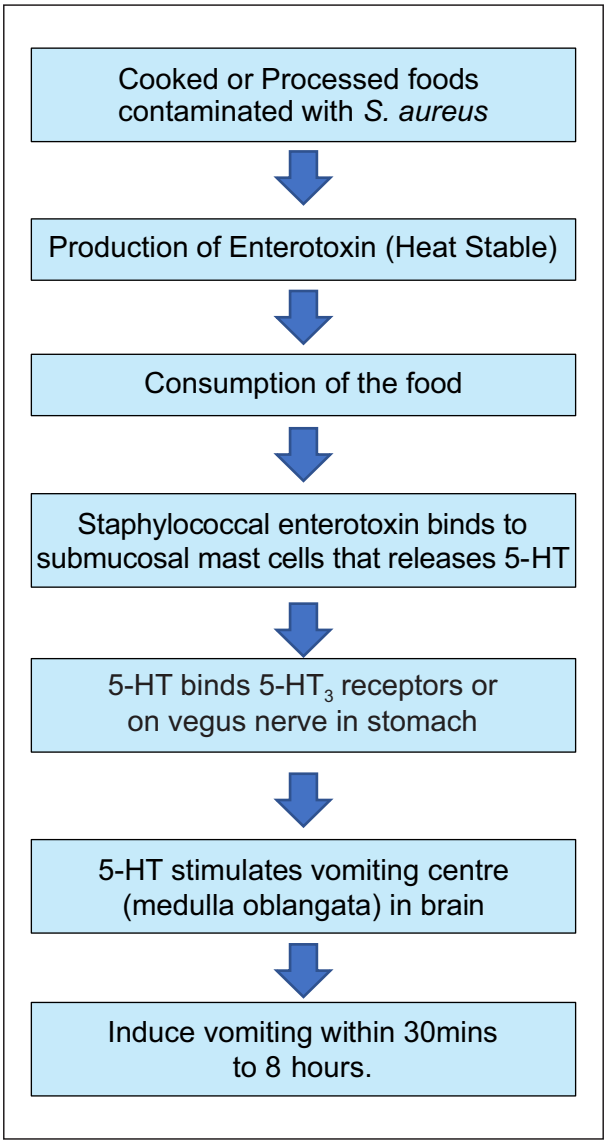
The disease results from ingestion of preformed enterotoxins in contaminated food rather than from infection or colonization by the bacteria.

Five conditions are required to induce S. aureus food poisoning: (1) a source containing enterotoxin-producing staphylococci: raw materials, healthy or infected carrier, (2) transfer of staphylococci from source to food linked to poor hygiene practices, (3) food composition with favourable physicochemical characteristics for *S. aureus* growth and toxinogenesis, (4) favourable temperature and sufficient time for bacterial growth and toxin production, and (5) ingestion of food containing sufficient amounts of toxin to provoke symptoms.

Most SFPOs arise because of poor hygiene practices during processing, cooking or distributing the food product. Moreover, after contamination, inadequate cooling of foods can induce *Staphylococcus* growth and/or stimulate toxin production, resulting in food poisoning.

Enterotoxins act as superantigens, causing non-specific activation of T lymphocytes and massive cytokine release. This leads to stimulation of the vagus nerve in the abdominal viscera, producing nausea,

vomiting, abdominal cramps, and diarrhea. This is highlighted in the flow-chart below.



The toxins are resistant to heat and gastric enzymes, which explains their survival during cooking and digestion.

CLINICAL FEATURES

Staphylococcal food poisoning presents as an acute gastrointestinal intoxication.

Onset: Rapid (1–6 hours after ingestion).

Symptoms:

a) Nausea
b) Projectile vomiting
c) Abdominal cramps
d) Watery diarrhoea
e) Occasionally headache, weakness, or mild fever.
f) If there is significant fluid loss, physical examination may reveal signs of dehydration and hypotension.

Duration: Symptoms are usually self-limiting, lasting 12–48 hours.

Complications: Rare, but severe dehydration can occur in infants, elderly individuals, or immunocompromised patients.

Importantly, the short incubation period and sudden onset of intense vomiting are clinical clues pointing to SFP.

DIAGNOSIS

Diagnosis is often clinical, especially in outbreak settings. However, laboratory confirmation can be achieved through:

Detection of Enterotoxin: Coagulase, haemolysins etc. are commonly used. Nowadays ELISA, PCR, and molecular methods can identify specific enterotoxins in food samples.

Isolation of S. aureus: Culture from suspected food or vomitus samples. Nutrient agar, blood agar, mannitol salt agar can be used and the organism gives golden yellow colonies that are catalase and coagulase positive. However colony count is important, and a colony count more than 10^5-10^6 per gram of food or feces is needed for causing infection and is thus diagnostic.[5]

Epidemiological Evidence: Linking consumption of a particular food to multiple similar cases within a short timeframe.

The highest incidence of Staphylococcal food poisoning usually occurs in people with poor personal hygiene, overcrowding and in children.[6] In developing countries, the surveillance system of FBD hardly exists and it is therefore, difficult to estimate the real magnitude of the problem. Even in countries where surveillance services are very efficient, the precise incidence of food poisoning is not known, as outbreaks are often not reported to public health authorities. Hence, the incidence of FBD caused by staphylococci is thought to be much higher than reported since many cases remain undeclared.

Because symptoms are self-limiting, most cases go unreported and unconfirmed.

Treatment

There is no specific treatment for staphylococcal food poisoning. Management is primarily supportive:

Rehydration therapy: Oral or intravenous fluids to correct dehydration and electrolyte imbalance.

Antiemetics: They can be used to control nausea and vomiting in severe cases.

Antibiotics: Not indicated, since the illness is toxin-mediated and bacteria are usually not colonizing the gastrointestinal tract.

Patients typically recover fully within 1–2 days.

PREVENTION AND CONTROL

This food borne illness is preventable. Consumers need to be aware of potential food contamination and cross-contamination in home and during cooking in kitchen. Preventing SFP requires strict food safety and hygiene practices, as the illness is entirely avoidable. Key measures include:

Personal hygiene: Food handlers should practice proper handwashing and avoid preparing food if they have skin infections or respiratory illnesses.

Temperature control: Cooked food should be kept either below 5°C (refrigerated) or above 60°C to prevent bacterial multiplication. Overall maintenance of cold chain is important.

Avoid prolonged storage: Do not leave cooked or ready-to-eat foods at room temperature for more than 2 hours.

Proper cooking: While toxins are heat-stable, proper cooking reduces the bacterial load, preventing toxin accumulation. The inner part of food (e.g. meat) should reach the temperature 60-65°C.

Food industry regulations: Routine monitoring of food for contamination and strict adherence to Hazard Analysis and Critical Control Points (HACCP) systems.

Two percent Mupirocin ointment can be applied to external nose to mitigate carriage of S. aureus in external nose.[7]

Case Studies and Outbreaks

Numerous outbreaks of SFP have been documented globally: 1985's staphylococcal food poisoning due to contaminated chocolate milk in Kentucky, USA, and 2000's extensive outbreak of staphylococcal food poisoning due to contaminated low-fat milk in Japan, are the classical examples of SFD.[2,8]

Bakery products: Cream-filled pastries stored at room temperature have caused large outbreaks.

Catered meals: Improper refrigeration of meat and poultry during large events often results in clusters of cases. Freezing, Pasteurization or reheating does not destroy the enterotoxin.[9]

Dairy products: Unpasteurized milk and cheese contaminated by farm workers have been mostly implicated in Staphylococcal food poisoning. The SE is an extremely potent gastrointestinal toxin, and as little as 100 ng is enough to cause symptoms of intoxication.[10]

These examples highlight the importance of food handling practices at all levels from production to consumption.

PUBLIC HEALTH SIGNIFICANCE

Staphylococcal food poisoning, though self-limiting, has significant public health implications:

High frequency: Large numbers of cases per outbreak due to communal food sharing.

Economic impact: Lost productivity, investigation costs, and food recalls. Causes a large economical loss.

Vulnerability of populations: Children, elderly, and immunocompromised individuals are at higher risk of complications.

Underreporting: Many mild cases never reach healthcare systems, making surveillance challenging.

Thus, awareness, surveillance, and preventive strategies are critical in reducing disease burden.

CONCLUSION

Staphylococcus aureus food poisoning is a classic example of a preventable foodborne intoxication. Caused by ingestion of heat-stable enterotoxins, it manifests rapidly with nausea, vomiting, and diarrhoea but typically resolves within 1–2 days without complications. The key to control lies in stringent hygiene, proper

food handling, and maintaining appropriate storage conditions. Public health authorities, food industries, and consumers all play a vital role in preventing outbreaks and ensuring food safety.

By adhering to safe food handling practices, the incidence of this common yet distressing illness can be greatly reduced.

REFERENCES

1. Staphylococcal food poisoning. Available from:- https://www.sciencedirect.com/topics/pharmacology-toxicology-and-pharmaceutical-science/staphylococcal-food-poisoning. Last accessed 13.9.25.
2. Sakr A, Bregeon F, Mege JL, Rolain JM, Blin O, *Staphylococcus aureus* Nasal Colonization: An Update on Mechanisms, Epidemiology, Risk Factors, and Subsequent Infections. Front Microbiol. 2018;9:2419.
3. Kadariya J, Smith TC, Thapaliya D, *Staphylococcus aureus* and Staphylococcal Food-Borne Disease: An Ongoing Challenge in Public Health. Biomed Res Int. 2014 ;2014:827965.
4. About Staph Food Poisoning. Available from:- https://www.cdc.gov/staph-food-poisoning/about/index.html. Last accessed 13.9.25.
5. Staphylococcus aureus (food poisoning). Available from:- https://www.bccdc.ca/health-info/diseases-conditions/staphylococcus-aureus. Last accessed 13.9.25.
6. Staphylococcal Infections. Available from:- https://www.health.vic.gov.au/infectious-diseases/staphylococcal-infections. Last accessed 13.9.25.
7. Van Rijen M, Bonten M, Wenzel R, Kluytmans J, Mupirocin ointment for preventing Staphylococcus aureus infections in nasal carriers. Cochrane Database Syst Rev. 2008; 2008(4):CD006216. doi: 10.1002/14651858.CD006216.pub2.
8. Asao T, Kumeda Y, Kawai T, Shibata T, Oda H, Haruki K, Nakazawa H, Kozaki S, An extensive outbreak of staphylococcal food poisoning due to low-fat milk in Japan: estimation of enterotoxin A in the incriminated milk and powdered skim milk. Epidemiol Infect. 2003;130(1):33-40. doi: 10.1017/s0950268802007951.
9. Necidova L, Bursova S, Harustiakova D, Bagdanovicova K, Lacanin I, Effect of heat treatment on activity of staphylococcal enterotoxins of type A, B, and C in milk. J Dairy Sci. 2019;102(5): 3924-32.
10. Saadat YR, Fooladi AAI, Shapouri R, Prevalence of enterotoxigenic Staphylococcus aureus in organic milk and cheese in Tabriz, Iran. Iran J Microbiol. 2014 ;6(5):345–349.