

SALMONELLA BACTERIA: CAUSE OF FOOD POISONING AND GIT INFECTIONS

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ABSTRACT

Objective: Food is essential for sustaining life, yet contamination of food frequently leads to food poisoning and gastrointestinal infection, particularly in infants, young children, elderly and immunocompromised individuals.

Salmonella typhi, which can produce lipopolysaccharide complex endotoxin, which plays critical role in the pathogenesis of typhoid fever.

More than 76 million cases of foodborne illness are reported annually in the United States alone which about 325000 cases are treated in hospitals in addition to about 5000 deaths. This review describes the pathogenic mechanisms of *Salmonella* species, its effect on the gastrointestinal tract and immune system, and current approaches to diagnosis, treatment, and prevention.

Traditional culture-based methods, rapid immunological assays (e.g., ELISA), and molecular techniques such as PCR are employed for the detection of *Salmonella*. Clinical manifestations typically include diarrhoea, abdominal cramps, fever, nausea, vomiting, and in severe cases, high fever, bloody stools, dehydration, and sepsis.

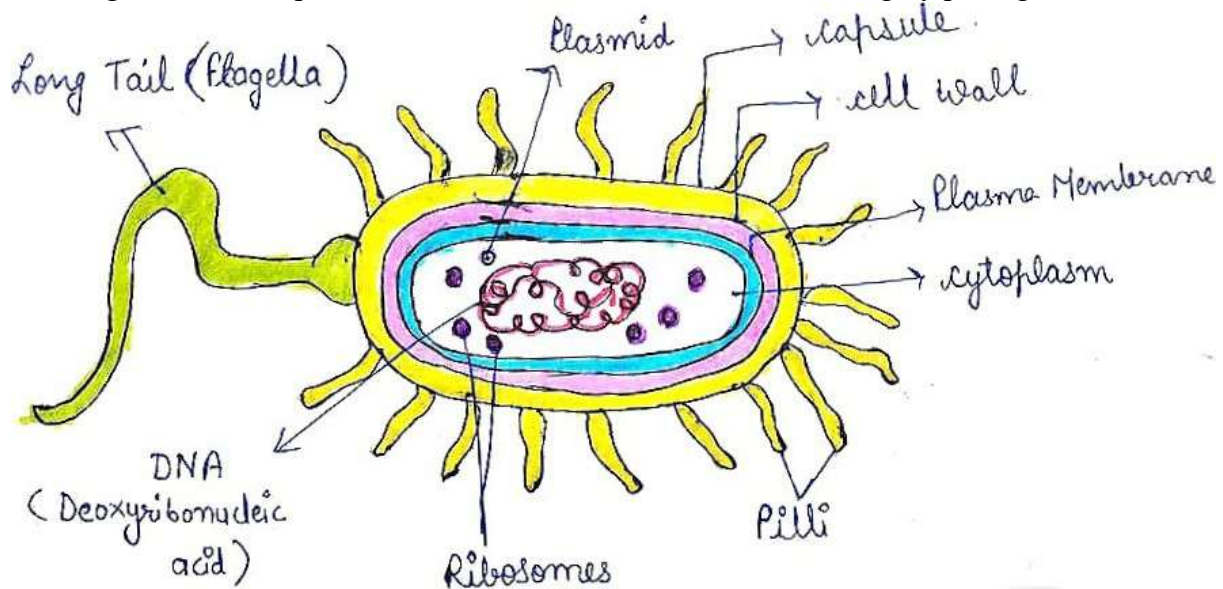
Keywords: *Salmonella Enteritidis*, *Salmonella Typhimurium*, non-typhoidal salmonella, foodborne illness, diarrhoea, antimicrobial resistance

INTRODUCTION:

Food poisoning arises from ingestion of food or water contaminated with pathogenic bacteria including, viruses, parasites, or their toxins. Globalisation of food production and trade has significantly increased the risk of contamination. Although most cases are self-limiting, foodborne diseases remain a major public health concern.

Non-typhoidal *salmonella* (NTS), particularly *salmonella enterica* serovars *Enteritidis* (*S. Enteritidis*) and serovars *Typhimurium* (*S. Typhimurium*), accounts for the majority of human “salmonellosis” worldwide, causing approximately 93 million cases of gastroenteritis and 155,000 deaths annually. *Salmonella* is a

Gram negative, rod-shaped, facultative anaerobic bacterium that is highly pathogenic in humans.



PATHOPHYSIOLOGY AND VIRULENCE MECHANISM OF *SALMONELLA TYPHIMURIUM*

1. Entry and survival: After the ingestion of contaminated food or water, most bacteria are killed by gastric acid; survivors reach the small intestine.

2. Adherence: Flagella and fimbrial adhesins enable the bacterium to approach and attach to intestinal epithelial cells.

3. Invasion : Salmonella uses a Type III secretion system (T3SS-1)- a inject effector proteins (SipA , SipB , SipC , SipE, etc) into host cells. These effectors trigger actin rearrangement , membrane ruffling and bacterial uptake by the epithelial cells.

4. Intracellular survival and replication: Inside the cell, Salmonella resides with a modified phagosome called the salmonella-containing vacuole (SCV). A second T3SS-2 injects additional effectors (e.g., SifA , SseF , SseG) that prevents lysosomal fusion , allowing intracellular replication. The resulting inflammatory response causes the characteristic symptoms of gastroenteritis (diarrhoea and abdominal pain) .

Epidemiology:

Salmonella bacteria are the major cause of food poisoning and gastrointestinal infections worldwide.

Global Burden

Big picture burden and trend:

At global level, *Salmonella* remains as one of the top global causes of foodborne diarrhoeal disease and continues to cause millions of illnesses each year, foodborne diarrhoeal diseases remain a large global health burden .

After a dip in many countries during 2020 (COVID-19 pandemic effects on testing, travel, and food supply chains) case reporting in 2022-2023 generally returned toward or above pre-pandemic levels in several regions. Europe reported in increase in notifications in 2023 compared with 2022.

1) **Regional numbers & surveillance highlights:**

European Union /EEA: salmonellosis was one of the top reported zoonoses. “In 2022 there was - ~65000 reported cases” and 2023 reporting showed increases in many countries (notification rate rising in 2023 vs 2022 in EU/EEA) surveillance and one health reporting continue to be published annually.

United States: salmonella remains as a leading cause of bacterial food illness. CDC surveillance identifies most common serotypes (e.g. *Enteritidis*, Newport, *Typhimurium* among top contributors) and continues to publish outbreak investigations and national burden estimates.

2) **Outbreak drivers and common food sources:**

Eggs and poultry are repeatedly implicated (notably *S. Enteritidis*) fresh produce, raw milk or unpasteurised dairy and sometimes processed foods or spice or herbal products have caused multi – state or multi country outbreaks in recent years. public health agencies continue to list active and recent investigations (e.g. egg linked recalls and raw milk outbreaks reported in 2023-2025).

3) **Serotypes and severity:**

A handful of serotypes account for about the majority of human foodborne salmonella infections in high income surveillance systems (e.g. *Enteritidis*, Newport, *typhimurium*). these serotypes also drive most hospitalizations in reported outbreaks.

4) **Antimicrobial resistance (AMR):**

AMR in salmonella is being tracked closely; reports from EFSA / ECDC show ongoing detections of resistance to common antimicrobials in isolates AMR complications treatment for severe invasive infections and is a growing surveillance and public health concern.

5) **Who is most affected:**

Young children, the elderly, the pregnant people and immunocompromised persons continue to be at higher risks of severe illness and hospitalizations. outbreak reports in recent years often show disproportionate impact on children’s (e.g. raw milk outbreaks where many cases were children).

Causes and sources:

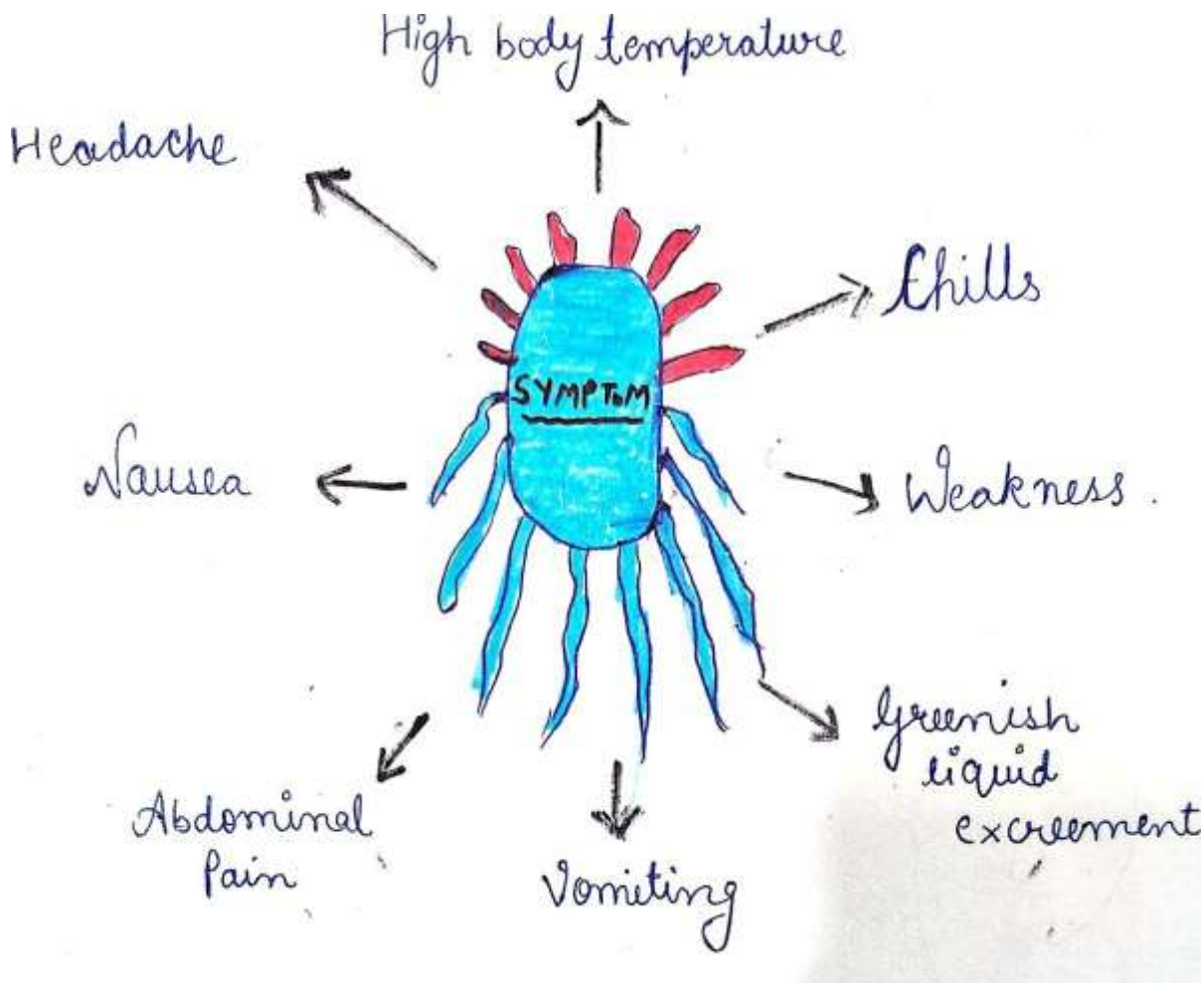
The common sources for salmonella infections are commonly from raw undercooked animal-based meals like chicken, meat or uncooked or contaminated eggs, peanut products, ground beef, pork, poultry. In very young or old, or those with a weakened immune system, the organism may spread and cause further infection in the heart, bones, and gallbladder. salmonellosis is a zoonosis and can be caught direct contact with animals carrying salmonella.

However, most of the 95% of cases are commonly from the consumption of contaminated food from infected animals or their products.

Some common symptoms:

The symptoms of the salmonella typically start from just after 6hrs to 72 hrs of exposure of ingesting the bacteria. Complications aren’t very common but may include reactive arthritis which mostly affects the ankles and knees and usually last for months. Diarrhoea, often bloody, abdominal cramps, gastrointestinal distress, nausea, vomiting, fever, weakness, are most common especially in children’s.

These symptoms typically last for approximately 4 to 7 days.



Treatment and prevention:

In the most common cases patient recover on their own but without complications. However, in serious conditions patient may need hospitalisation, mostly in the case of infants. and if the complications are higher than there may be a risk of death. these rare cases can occur due to sepsis and multi organ failure or dehydration.

Prevention of salmonellosis involves proper sanitation and hygiene practises, as well as the avoidance of insufficiently cooked or mishandled food.

Treatment can be done by taking supportive care, rehydration and taking electrolytes, and for infant's exclusive breast-feeding milk is recommended. Therefore, oral or intravenous fluids may be necessary. patients at high risk of developing a more severe illness may be offered a short course of oral antibiotics. and adults should practise proper handwashing.

Diagnosis:

Diagnosis of salmonella- associated food poisoning is primarily established through laboratory examination of stool samples testing. Rapid stool test which detects antigens and toxicants produced by salmonella in stool.

Molecular techniques, including polymerase chain reaction (PCR), are increasingly used due to their high sensitivity particularly in outbreak investigations. Blood culture is performed sepsis if suspected. the infection can also result in dehydration.

ANTIBIOTICS:

In these infections mostly antibiotics are not recommended firstly but in risky cases in children, pregnant women and immunocompromised patients.

Antibiotics advised such as fluoroquinolones, ciprofloxacin, levofloxacin are recommended for adults and azithromycin for children's.

Antibiotics are not routinely recommended for mild, uncomplicated salmonella GIT Infections because they may cause prolong the carrier state, alter the microbiota adversely, provide minimal benefit in symptom reduction.

Vaccination:

There is no vaccination available for salmonella because it has more than 2500 serotypes, making it difficult to create a complex, effective, and safe vaccine. the body does develop some immunity after salmonella infection but this immunity response is often serotype-specific, means it does not protect against other stereotype of salmonella.

Discussion:

Salmonella continues to be one of the most significant pathogens responsible for food borne illness and gastrointestinal infections across the world. as highlighted, its ability to survive harsh environmental conditions, adhere to intestinal epithelium, invade host cells through the Type III secretion system, replicate intracellularly makes it a highly adaptable and virulent microorganism. the process of host cells manipulation by effectors such as SIP A, SIP C and other invasion proteins plays a central role in development of inflammation and diarrhoea, which are hallmark symptoms of salmonellosis.

Epidemiological surveillance over the last several years shows that salmonella infections remain a persistent global public health burden, with millions of cases occurring annually. the temporary decline in reported infections during the COVID-19 pandemic reflects changes in food consumptions patterns, travel restrictions and lowered laboratory surveillance, rather than an actual reduction in disease prevalence. As surveillance systems returned to normal in 2022-2023, many regions – including the EU/EEA and United States – the reported a rise in salmonellosis cases.

Conclusion:

Salmonella remains a major contributor to global foodborne infections, posing significant clinical and public health challenges. its pathogenic mechanisms allow it to invade, survive and replicate within the host, leading to symptoms ranging from mild gastrointestinal discomfort to severe systemic illness. epidemiological data clearly demonstrate that salmonellosis is widespread and continues to rise in many regions mainly due to contaminated food sources, poor hygiene, and expanding antibacterial resistance.

Overall, this review highlights the importance of continuous awareness, education and research to better understand the pathogen, control its spread and protect the health of communities worldwide.

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