

Outbreak Reports

A Foodborne Disease Outbreak Caused by *Salmonella enterica* Serovar Braenderup (ST311) — Yangjiang City, Guangdong Province, China, July 2025

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Summary

What is already known about this topic?

Salmonella is a major foodborne pathogen, and eggs are established vehicles for common serotypes such as Enteritidis. However, rare serotypes like Braenderup are infrequently identified in outbreaks, partly due to limited routine surveillance and the low resolution of conventional typing methods.

What is added by this report?

This report documents a point-source outbreak of *Salmonella* Braenderup ST311 involving 130 cases (attack rate 19.2%, median incubation 17 hours). Sandwich consumption was strongly associated [corrected odds ratio=1,626.7 (Haldane-Anscombe correction); 95% confidence interval: 81.7, 32,360; $P<0.0001$]. The outbreak strain was isolated from 34 patients, leftover sandwiches, and raw eggs, with cgMLST allelic differences of 0–1. Whole-Genome Sequencing (WGS) linked it to 32 historical sporadic cases and one food isolate, indicating persistent local circulation.

What are the implications for public health practice?

Eggs can harbor rare outbreak-prone serotypes. Bakeries must separate raw/cooked materials and ensure hand hygiene. WGS was critical for early detection and traceback in this event.

control study ascertained the suspected food vehicle.

Results: Among 676 graduation ceremony attendees, 130 probable cases were identified. A case control study conducted among attendees confirmed that sandwich consumption was significantly associated with illness [corrected odds ratio=1,626.7 (Haldane-Anscombe correction); 95% confidence interval: 81.7, 32,360.0; $P<0.0001$], with 100% (96/96) of cases and only 9.4% (3/32) of controls reporting sandwich consumption, epidemiologically implicating bakery-produced sandwiches served during the event as the vehicle. WGS revealed clonal relatedness among *Salmonella* Braenderup sequence type 311 (ST311) isolates from 34 patients, one leftover sandwich, and one egg sample from the implicated bakery, with core genome multilocus sequence typing allelic differences of 0–1. The outbreak strain showed high genetic homology with 32 sporadic case isolates and one food isolate detected in Yangjiang since 2019, suggesting a persistent contamination source.

Conclusion: *Salmonella* Braenderup (ST311) caused this outbreak. Cross-contamination from eggs used in other bakery products was the most likely mechanism. The investigation highlights the emerging risk of eggs as vehicles for rare *Salmonella* serotypes and the significance of WGS-based surveillance in linking sporadic cases to point-source outbreaks.

ABSTRACT

Introduction: In July 2025, Yangjiang CDC received reports of five children from the same kindergarten with vomiting, abdominal pain, diarrhea, and fever, suggesting a foodborne outbreak.

Methods: A multi-agency team used epidemiology and Whole-Genome Sequencing (WGS) to identify the cause, source, and transmission chain. A case

On July 27, 2025, at 22:04, Yangjiang CDC was notified by Yangjiang People's Hospital that five children from TLB Kindergarten had presented to the fever clinic with vomiting, abdominal pain, diarrhea, and fever, raising suspicion of a foodborne outbreak. Municipal and district CDCs immediately initiated a field investigation. As cases accumulated, a provincial emergency response was activated, and a joint

investigation team was formed at provincial, municipal, and county levels. This study identified the cause and risk factors to inform prevention and control.

INVESTIGATION AND RESULTS

Epidemiological Investigation

On July 26, 2025, from 14:00 to 18:00, TLB Kindergarten held a joint graduation ceremony for its Jiangcheng and Yangdong campuses at M Hotel in Jiangcheng District. A total of 676 persons attended: 231 children, 35 staff, and 410 family members. At around 16:00, a uniform afternoon snack — commercially packaged M brand milk and sandwiches produced by AEQ Bakery — was provided to the children. Out of the total of 300 sandwiches, 231 were distributed to children, and the remaining 69 were consumed by on-site staff and family members. Some

children also shared their sandwiches with their family members.

Case Definitions

Probable Case: An individual who attended the TLB Kindergarten graduation ceremony at M Hotel on July 26, 2025, or a family member of an attendee, presenting with fever (axillary temperature $\geq 37.3\text{ }^{\circ}\text{C}$) and diarrhea (≥ 3 episodes/24 hours with altered stool consistency) with onset on or after July 26, 2025.

On the evening of July 26, attendees developed fever, diarrhea, and vomiting; the index case developed symptoms at 20:00. The incubation period ranged 4–49 hours, with a median of 17 hours. A total of 130 probable cases were identified: 67 males and 63 females, including 109 children and 21 family members or staff. Specifically, among these 21 cases, 7 were adults and 14 were children not enrolled in the kindergarten. The median age was five years, with an

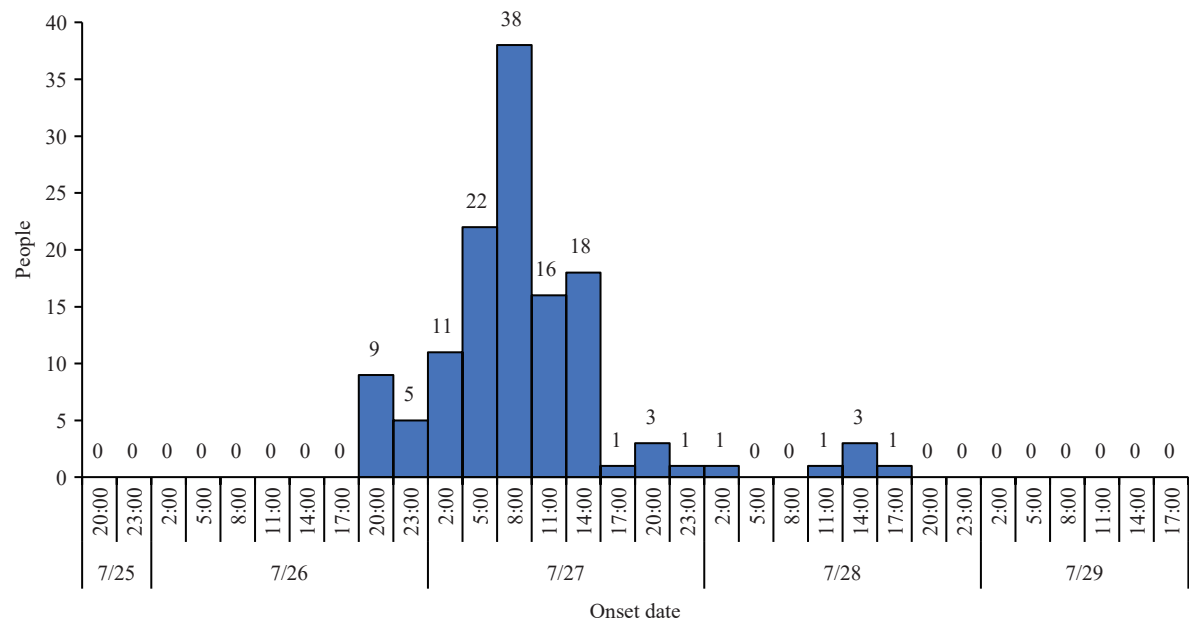


FIGURE 1. Epidemic curve of onset dates for suspect cases (n=130) of *Salmonella* Braenderup infection, Yangjiang City, Guangdong Province, China, July 2025.

TABLE 1. Attack rates among children by kindergarten campus and class, Yangjiang City, 2025.

Variable	Group	Cases (n)	Total (N)	Attack rate (%)	χ^2	P
Campus	TLB Jiangcheng Campus	75	155	48.39	0.27	0.602
	TLB Yangdong Campus	34	76	44.74		
Class	Preschool classroom	29	53	54.72	2.00	0.573
	Senior	43	94	45.74		
	Middle	26	56	46.43		
	Junior	11	28	39.29		

age range of 1–43 years. The overall attack rate was 19.2% (130/676). The epidemic curve exhibited a typical point-source pattern, with symptom onset concentrated on July 26–27 (Figure 1). No severe cases or deaths were reported. The attack rates of children in the two campuses were similar: 48.4% (75/155) and 44.7% (34/76) for the Jiangcheng and Yangdong campuses, respectively ($\chi^2=0.27$, $P=0.602$). The differences in attack rates among different classes was statistically insignificant (Table 1).

Food Hygiene Investigation

The afternoon snack on July 26 was the only common meal exposure among all attendees. Commercially packaged milk was excluded because of its wide distribution; contamination would have caused a geographically widespread outbreak. Based on the initial finding of *Salmonella* in five laboratory-confirmed cases, sandwiches became the focus of investigation.

The 180 m² AEQ Bakery (Hongfeng Town, Yangdong District) has food-processing and storage rooms, but no dedicated cleaning and disinfection area or video surveillance. Both pastry chefs denied any recent illness. Hygiene was poor: visible stains on refrigerators and ovens, uncovered food inside refrigerators, disorganized utensils, and mixed storage of raw eggs, opened meat floss, and cooked foods. In the week before the event, the bakery sold 50–150 pastries daily. On July 26, it produced 300 sandwiches — all sold to TLB Kindergarten. Sandwiches were made of bread slices, salad dressing, ham slices, and meat floss. Bread slices were prepared one day in advance and stored at room temperature. Pastry chefs did not wear gloves during dough preparation and baking (Figure 2).

Case-control Study

A case-control study was conducted among all graduation attendees, from whom 96 case-patients and 32 controls were randomly selected. The control group ($n=32$) was smaller than the case group ($n=96$) because of staffing and time constraints during the field investigation. All 96 case-patients (100%, 96/96), but only three controls (9.4%, 3/32) reported sandwich consumption, which was significantly associated with the illness [corrected odds ratio (OR)=1,626.7 (Haldane-Anscombe correction); 95% confidence interval (CI): 81.7, 32,360.0; $P<0.0001$]. Because of a zero cell in the 2×2 table, we applied the Haldane-Anscombe correction (adding 0.5 to each cell) to

obtain a finite odds ratio estimate. This confirmed sandwiches as the vehicle.

Laboratory and Whole-Genome Sequencing Analysis

Microbiological testing was performed according to the national standard (GB 4789.4-2024). Anal swabs from suspected cases, leftover food (sandwiches and milk), and bakery ingredients and environmental samples were collected. Swabs were plated on selective media; suspected colonies were identified by matrix-assisted laser desorption ionization time-of-flight mass spectrometry and serotyped using specific Cell (O) antigen and flagella (H) antigen antisera from Statens Serum Institut, Denmark. Representative isolates underwent Whole-Genome Sequencing (WGS). DNA was extracted using the Magen Hipure Bacterial DNA Kit, and paired-end sequencing of 2×150 base pairs was performed on an Illumina HiSeq 2000 platform. Data analysis yielded multilocus sequence typing, resistance genes, and virulence factors. Sequencing results were compared with a historical *Salmonella* allele database to determine homology with prior cases.

No *Salmonella* was isolated from environmental samples or food handler anal swabs. *Salmonella* Braenderup was isolated from patient specimens, leftover sandwiches, and raw egg samples from the bakery. WGS confirmed high genetic homology among isolates from 34 patients, one leftover sandwich, and one egg sample. Traceback identified the eggs as originating from L Farm in Gaozhou City, supplied by TM Food Co., Ltd. Although eggs were not a direct ingredient of the sandwiches, they were used in pastries produced concurrently at the bakery, strongly suggesting cross-contamination.

All outbreak-related isolates were ST311. Core genome multilocus sequence typing (cgMLST) showed that 15 human isolates and one sandwich isolate clustered together with zero allelic differences; they differed by only one allele from the egg isolate. Notably, the outbreak strain was genetically highly homologous to 32 sporadic case isolates and one food isolate reported in Yangjiang from 2019 until just before this outbreak, suggesting a common source (Figure 3).

PUBLIC HEALTH RESPONSE

Based on these findings, public health measures were implemented: enforcing strict separation of raw and cooked materials, ordering the implicated bakery to

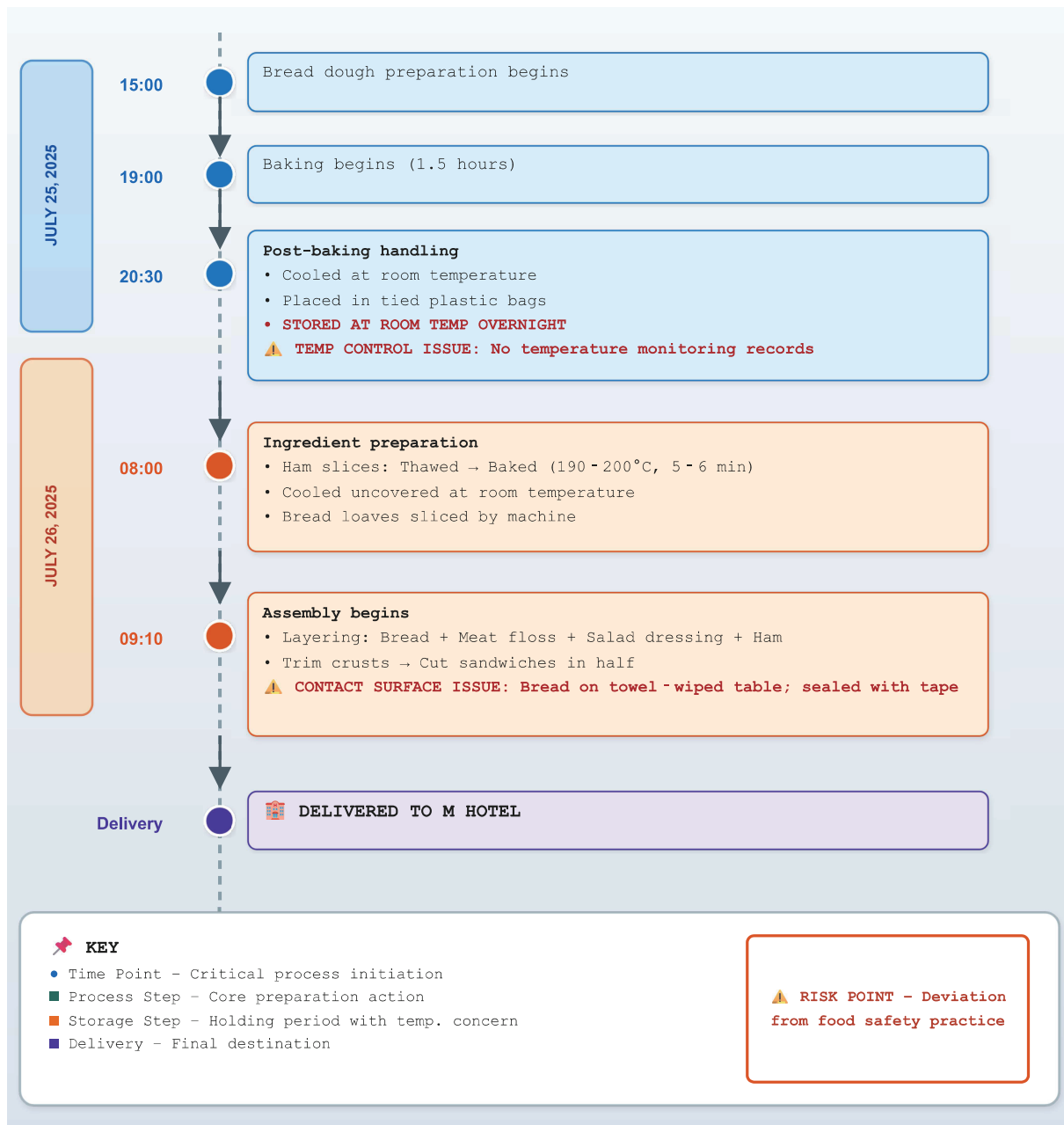


FIGURE 2. Timeline of sandwich preparation, storage, and transportation in a foodborne disease outbreak investigation, Yangjiang, China, July 2025.

suspend operations for rectification, strengthening food procurement supervision in kindergartens, and integrating genomic surveillance for early detection and traceback of persistent contamination sources by rare *Salmonella* serotypes.

DISCUSSION

This report describes a point-source outbreak of *Salmonella* Braenderup ST311, with a complete chain of evidence from patients to the common food

vehicle — sandwiches, and to the contaminated ingredient — eggs, as established by WGS. *Salmonella* remains a leading cause of foodborne disease worldwide, and its vehicles have expanded from traditional animal-derived products to agricultural commodities (1–3). *Salmonella* Braenderup is common in Europe and the Americas, associated with both agricultural and animal-derived foods (4–5), but is rare in China. In Guangdong Province, ST311 has become a locally dominant sequence type, but previous cases were sporadic with diverse suspected foods, rendering

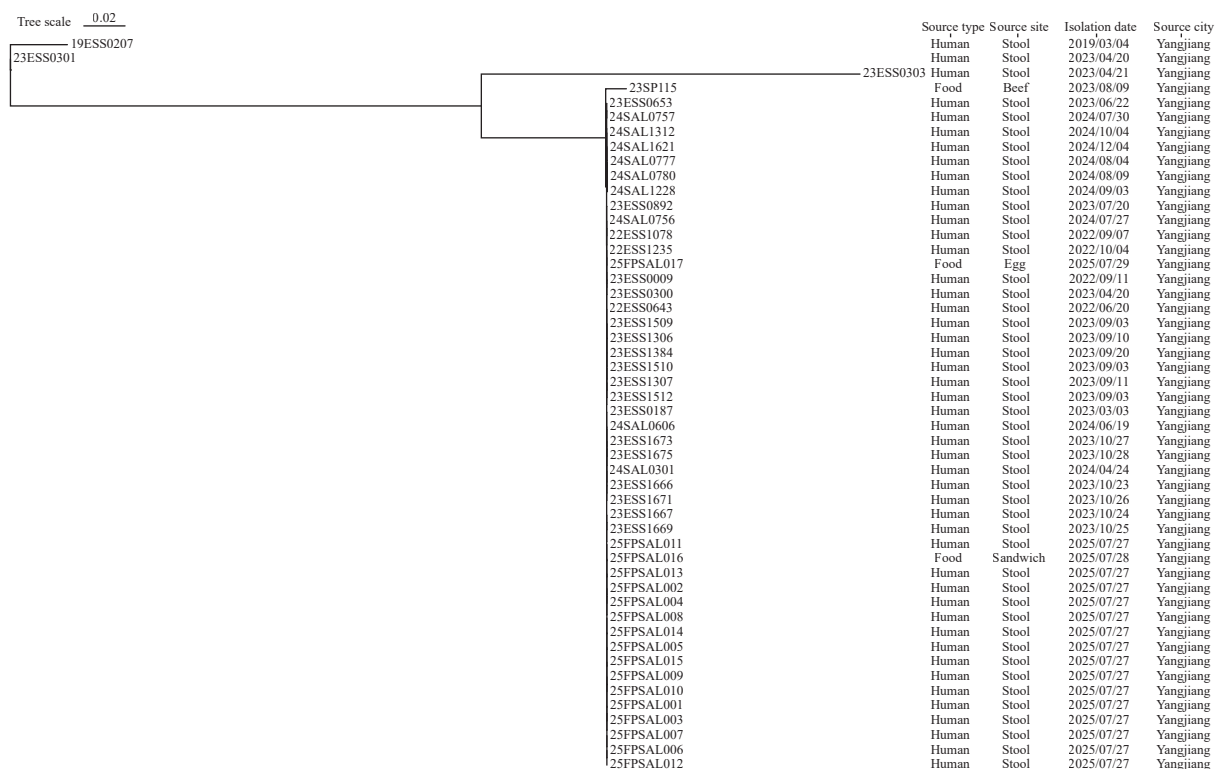


FIGURE 3. Cluster analysis of *Salmonella* Braenderup isolates from outbreak and historical passive surveillance based on cgMLST.

Abbreviation: cgMLST=core genome multilocus sequence typing

traceback difficult.

This outbreak demonstrates that eggs can transmit not only common serotypes such as *Salmonella* Enteritidis, which is responsible for approximately 92% of egg-associated outbreaks globally (6), but also rare serotypes like *Salmonella* Braenderup ST311. The typical incubation period for salmonellosis ranges 6–72 hours (2); however, the outbreak index case had an incubation period of merely 4 hours. This unusually rapid onset is likely attributable to a combination of host- and exposure-related factors: the affected child's immature immune system, lower gastric acidity, and reduced physiological resistance may have accelerated disease progression, while children who consumed contaminated sandwiches may have received a higher bacterial load relative to body weight, further shortening the incubation period (7). Isolation of the outbreak strain from pasteurized egg contents suggests that surface disinfection of eggshells alone may not prevent internal contamination (8–10). The affected population was predominantly young children, who are more susceptible to *Salmonella* infection and at higher risk for severe disease. This highlights the significance of prioritizing pasteurized egg products and promoting staff training in group meal settings

such as kindergartens. Additionally, it demonstrates the critical role of WGS in responding to outbreaks caused by rare serotypes. The ability of WGS to link outbreak strains to historical sporadic cases transcends simple matching, revealing that seemingly isolated sporadic cases are often clues to a persistent, hidden source. This changes outbreak thinking: rare serotypes are not random accidents but signals of long-term endemic circulation.

In summary, this outbreak shows that eggs can serve as vehicles for rare *Salmonella* serotypes with epidemic potential. The genetic relatedness between the outbreak strain and historical sporadic isolates indicates that this serotype has become endemic in the local area. Effective hygiene management in food establishments — separation of raw and cooked materials, hand hygiene, glove use, etc. — is essential for preventing cross-contamination. Integrating genomic surveillance into layer farming and egg processing will facilitate early detection and control of emerging serotypes.

This study has a few limitations. First, shortage of resources for on-site epidemiological investigation restricted complete interviews with all 676 attendees, yielding a relatively small control group in the case

control study, which may have somewhat reduced the statistical power. Nevertheless, the significant association between exposure (consumption of sandwiches) and illness ($OR=\infty$, $P<0.0001$) supports the robustness of this finding. Second, despite a thorough investigation among all kindergarten children and staff, we could not ascertain the total number of adults and children among all family attendees (including those who did not become ill) because of the large number of family attendees and the small number of sandwiches consumed. Moreover, sandwiches were primarily distributed to children; few adults were actually exposed. Consequently, we were unable to determine the attack rates separately for children and adults, nor perform a meaningful age-stratified comparison. Nonetheless, the consistently high attack rates among children across the two campuses (48.4%, Jiangcheng; 44.7%, Yangdong) strongly implicate sandwiches as the primary vehicle.

Conflicts of interest: No conflicts of interest.

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