

Outbreak of *Salmonella* Singapore associated with eating sushi

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An outbreak investigation of *Salmonella* Singapore associated with sushi consumption in Queensland was conducted in March–April 2004. There appear to be no previously published outbreaks of salmonellosis associated with sushi consumption in Australia.

On 30 March 2004, Queensland Health Scientific Services notified the Queensland OzFoodNet site (Queensland Health Communicable Diseases Unit) of a cluster of six cases of *S. Singapore* infection, with specimen collection dates over a ten day period. All cases were 20–39 years of age and lived in the Brisbane and Gold Coast regions.

Telephone interviews were initially conducted for five cases using a hypothesis-generating questionnaire. These interviews revealed that all five cases worked in the Brisbane Central Business District (CBD) and had eaten takeaway sushi as a lunch meal in the five days prior to their illness. Four cases reported eating takeaway sushi rolls from the same sushi takeaway outlet (outlet A) and one case from a different sushi outlet in the Brisbane CBD (outlet B).

A case control study was commenced to attempt to identify the likely food vehicle or source of infection for this outbreak. A case was defined as either a

laboratory confirmed case of *S. Singapore* infection notified from 28 March or an epidemiologically linked case who reported a gastrointestinal illness including diarrhoea within three days of eating sushi at outlet A or after eating sushi for a lunch meal with a laboratory confirmed case from 15 March. Population-based controls were sourced from Queensland Health employees working in corporate office in the Brisbane CBD and were matched to cases by gender and broad age groups. Case-nominated controls who attended the sushi outlet at the same time as the case were also sought, but insufficient numbers excluded their use in the analysis.

Thirteen cases of *S. Singapore* infection were notified to Queensland Health between 29 March and 7 April 2004. Eleven laboratory confirmed and one epidemiologically-linked case were interviewed. Sixteen population-based controls were eligible to participate and were included in the study. All but one case worked in the Brisbane CBD and all cases had eaten a lunch meal in the Brisbane CBD. Cases had a median age of 26 years (age range 20–34 years), five (42%) were male and seven (58%) were female. Controls had a median age of 34 years (age range 25–56 years), four (25%) were male and twelve (75%) were female.

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All 12 cases reported stomach cramps and diarrhoea while only one case reported vomiting. The median duration of illness was 5.5 days (range 3 to 9 days) for the eight cases who were no longer symptomatic when interviewed. No cases were hospitalised.

All 12 cases ate a lunch meal from a sushi outlet in the Brisbane CBD in the seven days prior to their illness. Eleven of these 12 cases consumed a sushi roll for lunch from the same sushi outlet (outlet A) over an 18-day period between the 16 March and 2 April 2004. Seven of the 16 controls ate a lunch meal from a sushi outlet in the Brisbane CBD during the same exposure period but none from outlet A. *S. Singapore* infection was associated with eating a sushi roll from outlet A (odds ratio undefined; $p < 0.001$). An association between specific food items from a sushi outlet and illness could not be established from this study as cases consumed a wide variety of sushi rolls and frequently consumed more than one type. A variety of other takeaway food venues were included in the case control study but none were significantly associated with infection.

An environmental investigation of outlet A was conducted on 6 April. Food items (raw and cooked) were sampled for analysis and swabs were obtained from food preparation equipment and areas. All samples were culture negative for *Salmonella* species. The inspection identified several food hygiene issues including inadequate hand washing facilities, bare hand contact with ready-to-eat food, and mayonnaise prepared on-site with raw egg yolk as an ingredient but separating the yolk from the white using the egg shells. The mayonnaise was prepared weekly and was left at room temperature during opening times. Eggs were traced to a large producer which had quality systems in place including egg washing. The internal temperature of displayed sushi products when measured with a temperature probe varied between 17°C and 24°C. No illness was reported among staff members.

The probable vehicle of *S. Singapore* infection in this outbreak was sushi rolls purchased from outlet A in the Brisbane CBD, however, the environmental investigation could not confirm the source of the *Salmonella*.

Outbreaks of foodborne disease associated with sushi have rarely been described in the literature. Sushi rice is generally handled (moulded or pressed) at temperatures between 21°C and 25°C and usually involves considerable bare hand contact. Traditionally, sushi is not refrigerated and is often displayed and eaten at room temperature. Pathogen growth may be inhibited through acidification of the rice. However sushi may contain potentially hazardous foods used as fillings. Acidification of the rice will not necessarily inhibit pathogen growth in the fillings.

A recent microbiological survey of sushi conducted in the Australian Capital Territory¹ showed that 17/55 (31%) sushi samples were contaminated with potential foodborne pathogens at levels outside of acceptable microbiological limits for ready-to-eat foods². This survey found only 63% of rice samples had a pH below the recommended level³ of ≤ 4.8 with a median of 4.7 (range 4.3–5.9). The median temperature of 45 sushi samples tested was 15°C (range $<5^{\circ}\text{C}$ – 25°C).

The Australia New Zealand Food Standards Code requires that potentially hazardous food (such as sushi) be displayed under temperature control (5°C or less). However, potentially hazardous food may be displayed at another temperature if the food business demonstrates that maintenance of the food at this temperature will not adversely affect the microbiological quality of the food.

The Victorian Department of Human Services has recently developed a sushi supplement for businesses with a food safety program that prepare, receive and/or display sushi³. Food businesses that strictly adhere to the recommended procedures can display sushi (nori rolls) for up to 12 hours out of temperature range if the display temperature is maintained at $\leq 15^{\circ}\text{C}$ and the pH of the rice is ≤ 4.8 . For businesses that do not wish to adhere to these guidelines, sushi displayed at $>5^{\circ}\text{C}$ should be eaten after 2–4 hours or discarded after more than four hours.

As this outbreak involved food prepared and consumed over an 18-day period, it is likely that *Salmonella* was introduced from a contaminated raw product and used directly as an ingredient or was a constituent of one of the sushi ingredients. It is doubtful whether adherence to the above guidelines would have prevented the occurrence of this outbreak.

References:

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