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Food Poisoning by *Staphylococcus aureus* at a University Festival

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Temporary food stalls run by students are very common at university festivals in Japan. Although it is mandatory for students opening stalls to receive instructions on food handling rules, submit a plan according to the regulations, and receive permission from the local health authority, there remains a risk of food poisoning at such stalls. A group of first-grade medical students formally permitted by the local authority opened a stall serving crepes at Nagoya University Festival in 2008. Around 16:00 of June 7, the third day of the festival, an outbreak occurred around the stall; tens of visitors to the festival exhibited nausea, vomiting, and stomach pain. This paper describes the outbreak as well as experiments performed to confirm its cause.

The outbreak was reported to the local health center at 17:40 on the same day that it occurred. The local health authority immediately started collecting residual foods, utensils, and vomitus, and interviewing the individuals with symptoms concerning the onset and the food they ate using a food poisoning investigation form. The cases were defined as individuals who had nausea, vomiting, stomachache, and/or diarrhea between 0:00 a.m. of June 7 and 24:00 of June 8 after eating food at Nagoya University Festival. After the news was reported on TV and in the newspaper, 83 persons aged 6 to 65 years reported to have the above digestive symptoms in the restricted period. Among them, two did not take part in the authority's interview, three did not eat the crepes from the stall in question, and another three ate crepes from the stall on June 6. The remaining 75 individuals (90.4% of 83 cases) stated that they ate crepes at the same stall on June 7. Although festival visitors without symptoms were not interviewed, it seemed unlikely that a corresponding percentage of thousands of visitors ate the crepes. The finding indicated epidemiologically that the source of food poisoning was the crepes sold at the stall on June 7.

The interview survey elucidated that the latent period between crepe intake and symptom appearance ranged from 1 to 9.5 h except in the case of a 65-year-old man whose detailed information was unavailable due to an auditory problem and one individual with a 29-h latent period; the average was 4.2 h excluding those two cases. Among 74 cases excluding the 65-year-old man, 90% exhibited vomiting, 89% had nausea, 73% had diarrhea, 69% had abdominal pain, and 24% had fever (37.0 - 39.0°C). Four patients with severe symptoms were admitted to the hospital and recovered within a few days. As described below, 540 crepes were made, so it is likely that the number of persons who ate the crepes was close to this number. Since the number of contaminated crepes was unknown, it was difficult to estimate what percentage of persons who ate the crepes had symptoms.

Staphylococcus aureus with coagulase III and enterotoxins A and C was detected in 5 out of 14 samples collected from food residuals, as well as in 7 out of 8 samples swabbed from bowls, spoons, a spatula, and the insides of food boxes, but no agricultural chemicals (69 items) or poisons (sodium azide, Hg, Pb, and Cr) were detected. Stool specimens from 17 patients confirmed 11 patients with *S. aureus* with coagulase III and enterotoxins A and C and one patient with *S. aureus* with coagulase V and enterotoxin B. The students serving the crepes at the stall also ate the crepes and some had symptoms of food poisoning. Stool samples from the students who cooked the crepes showed that 4 out of 8 were positive for *S. aureus* with coagulase III and enterotoxins A and C. Finger swabs of 25 students showed that two students were positive for *S. aureus* with coagulase III and enterotoxins A and C, one student was positive for coagulase of unknown type and enterotoxins A and C, and one student was positive for *S. aureus* with coagulase V and enterotoxin B. Since the students themselves ate the crepes, these tests could not identify the origin of the infection. Based on these findings, it was concluded that the outbreak was due to *S. aureus* with coagulase III and enterotoxins A and C.

Although preparing food on the day before the festival took place was prohibited by the health authority, the students started to cook crepes on June 6: 450 crepes from 21:00 to 01:20 and another 90 crepes from 02:00 to 05:00 of June 7. The crepes were wrapped in groups of 15 before cooling down. While 150 crepes were stored in a home refrigerator, the remaining 390 crepes were kept at room temperature. The students in charge of cooking the crepes did not use caps, masks, gloves for food handling, nor disinfectants for finger disinfection. In the process of wrapping, some students folded the crepes by touching the centers of the crepes where the temperature seemingly remained high for a long time. The crepes were served with fruits, pudding, cheese cake, and so forth, from 11:00 to 15:30 of June 7. No association was observed between the food poisoning and the foods added to

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the crepes. At a maximum, 18.5 h passed between the time the crepes were cooked and time they were sold.

With the cooperation of the students, the process was reproduced on June 16. The temperatures of the crepes stored in a refrigerator and of those stored at room temperature were measured under the same conditions with respect to the kitchen, refrigerator, cooks, and wrapping process. Four thermoprobes were set in the upper, middle, and lower layer crepes stored in the refrigerator as well as in the crepes stored at room temperature. Figure 1 shows the changes in temperature for each thermoprobe, as well as the temperature of the room. The measurement started at around 21:00 and ended around 07:00 of the next day. The recorders of the temperature for the middle and lower layer crepes in the refrigerator stopped around 6 h after the start because of mechanical problems. However, it was clearly demonstrated that the crepes did not cool down to 25°C within a short time; at the shortest, it took 3 h for the upper layer crepes in the refrigerator to cool to 25°C, and at the longest it took more than 11 h for the crepes kept at room temperature to cool 25°C. Figure 2 demonstrates the growth of *S. aureus* and the production of enterotoxins in the crepes. In this experiment, the crepes baked on June 16 and *S. aureus* isolated from the outbreak of June 7 were used. Within 6 h, the enterotoxins were produced in crepes stored at 25°C or 35°C. In a previous experiment using skim milk, enterotoxin A was produced at a higher speed after 8 h of incubation at 35°C (1). Our findings were consistent with this previous study.

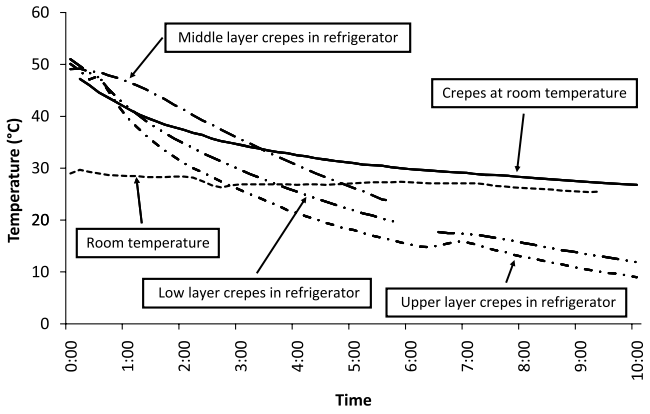

Fig. 1. Changes in the temperature of crepes stored in a refrigerator and at room temperature. Fifteen crepes with a thermoprobe at the center were wrapped with two plastic sheets. Three bunches of wrapped crepes (45 crepes in total) were piled up and placed in a refrigerator. One bunch of crepes (15 crepes) was placed in the room.

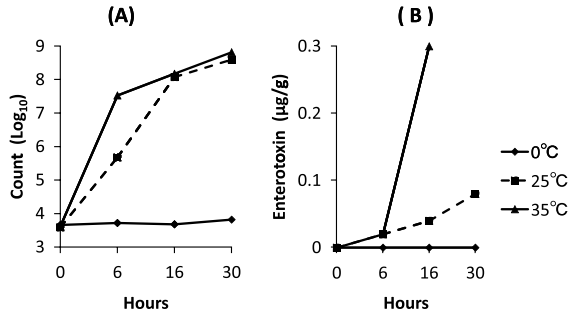

Fig. 2. (A) Counts of *Staphylococcus aureus* inoculated in the crepes and (B) enterotoxins production according to temperature of incubation.

Although the size of the outbreak was not very large in comparison with the outbreak that occurred in the Kansai area in 2000 through low fat milk (2), this outbreak presented another type of food poisoning risk. Temporary food stalls at school festivals are under the regulation of the local health authority. However, if students ignore the food handling rules, a real risk of food poisoning is present. This outbreak might have been prevented if the cooks had used disinfectants or gloves, or if the crepes had not stored for such a long time. Lack of knowledge as to how to avoid food poisoning and ignorance of the rules among the medical students were the causes of this outbreak.

The teaching staff of the medical school may also bear some responsibility for this outbreak. One author (N.H.) apologizes for not providing the students with the relevant information and not instructing them in the importance of obeying the rules before this outbreak occurred. We will cite this case in educational classes on food poisoning. It was quite fortunate that all of the patients recovered without serious health or mental problems. It seemed that the early responses to the outbreak involving the cooperation of the local health authority, ambulance rescue teams, hospitals, and university were able to minimize the damage to the community.

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