Outbreak of Scombroid Fish Poisoning, Taiwan

CHEN KOW-TONG, MD, AND MICHAEL D. MALISON, MD

Abstract: Fish implicated in outbreaks of scombroid poisoning have usually undergone prolonged storage at an inadequate temperature. We report an outbreak of scombroid poisoning in which fish stored on ice for two days caused illness after standing at room temperature for only three to four hours; fish from the same catch did not cause illness after standing at room temperature only one hour. This outbreak suggests scombrotoxins may be produced more rapidly than previously thought possible. (*Am J Public Health* 1987; 77:1335–1336.)

Introduction

Scombroid poisoning, one of the most common adverse reactions to eating fish, is characterized by flushing, headache, dizziness, burning of the mouth, abdominal cramps, vomiting, and diarrhea. Although symptoms resemble those of an allergic reaction, the illness is caused by the ingestion of toxins produced by bacterial spoilage of fish. Histamine is found in varying concentrations in fish associated with outbreaks, but it is unknown whether illness is caused by the direct action of histamine, or by other factors which potentiate its effect.[1,2] Scombroid means "mackerel-like", and dark-meat fish of the mackerel family (e.g., mackerel, tuna, and bonito) are often implicated in scombroid outbreaks, although 42 per cent of outbreaks reported to the US Centers for Disease Control from 1978–1982 were associated with non-scombroid fish.[3] Outbreaks are commonly reported in Japan, Canada, the United States, and other countries with a high dietary intake of fish.[4] In most outbreaks, fish contain high levels of histamine and have been stored at room temperature for many hours or even days. In this article, we report an outbreak of scombroid fish poisoning in which implicated fish had been stored at room temperature for only a few hours.

Background

On July 4, 1986, 41 employees of a department store in southern Taiwan were hospitalized shortly after eating lunch in the employee cafeteria. Ill employees complained of dizziness, headache, palpitations, and perioral numbness. Symptoms occurred within a few minutes to a few hours after eating lunch. Several persons were treated with antihistamines and showed immediate improvement. An epidemiologic investigation was undertaken to better characterize the outbreak and determine its cause.

Methods

Clinical and laboratory information was obtained from the medical records of all hospitalized employees. A questionnaire was administered to all 500 employees who ate lunch in the store cafeteria on July 4. Leftover fish were analyzed for histamine concentration by the method of Behling and Taylor.[4]

Results

A total of 340 questionnaires (68 per cent) were returned; 115 employees (34 per cent) reported signs and symptoms (Table 1). The incubation period ranged from 10 minutes to four hours with a median of 40 minutes. All cases recovered within 24 hours. The time of onset of illness suggested a common source exposure (Figure 1).

The lunch menu consisted of fried fish (white-tipped mackerel), fried pork with vegetables, boiled bean curd, and vegetable soup. Fish was the only food associated with illness: 115 (56 per cent) of 204 employees who ate fish compared to none of 136 who did not eat fish were ill. Lunch was served to employees in 40-minute shifts starting at 10:30 am. An analysis of attack rates by the time lunch was eaten revealed a clear trend toward higher attack rates among employees who ate during later shifts (Table 2). Fish was not served after 1:00 pm because several employees were already ill and complained the fish had a peculiar taste. None of 112 employees who ate lunch after 1:00 pm compared to 115 of 228 who ate lunch before 1:00 pm became ill.

Rectal swabs from 22 hospitalized employees were negative for *Salmonella, Shigella,* and *Vibrio* species.

On July 3, a department store cook had purchased 200 kg of mackerel from a fishing boat in Kaohsiung Harbor. The fish had been netted during the early morning hours of July 2, and immediately placed in the boat's hold and covered with a layer of ice. The boat returned to Kaohsiung Harbor on the morning of July 3, and sold the fish to the department store cook around 9:00 am. The cook placed the fish in four large plastic buckets holding about 50 kg each, and immediately covered the fish with ice. Two buckets of fish were delivered to store A (the store in which the outbreak occurred), and two to store B. The time required to transport the fish from the boat to the two department stores was approximately two to three hours. In each store, the buckets were immediately placed in large walk-in refrigerators with a recorded temperature of 4°C. In store A, the fish were removed from the refrigerator at 7:00 am on July 4, cleaned, and left to stand at room temperature (about 30°C) for three to four hours. Fish was fried from 10:00–11:00 am in several batches; fish eaten by employees in later lunch shifts stood at room temperature approximately one hour longer than fish eaten by employees in earlier shifts. Before the fish were cooked at 10:00 am, a small portion was put back in the refrigerator to be prepared

TABLE 1—Signs and Symptoms of 115 Cases of Scombroid Poisoning

Sign or Symptom	No. of Cases (%)
Dizziness	90 (78)
Flushing	71 (62)
Headache	59 (51)
Nausea	42 (37)
Perioral numbness	40 (35)
Palpitations	35 (30)
Pruritus	32 (28)
Fever	28 (24)
Diarrhea	15 (13)

Address reprint requests to Dr. Michael D. Malison, International Health Program Office, Global EIS Program, Centers for Disease Control, Atlanta, GA 30333. (He is currently on assignment to Emory University, Department of Community Medicine, from CDC.) Dr. Chen is with the Field Epidemiology Training Program, Bureau of Disease Control, Department of Health, Executive Yuan, Taiwan, Republic of China. This paper, submitted to the Journal December 29, 1986, was revised and accepted for publication March 26, 1987.

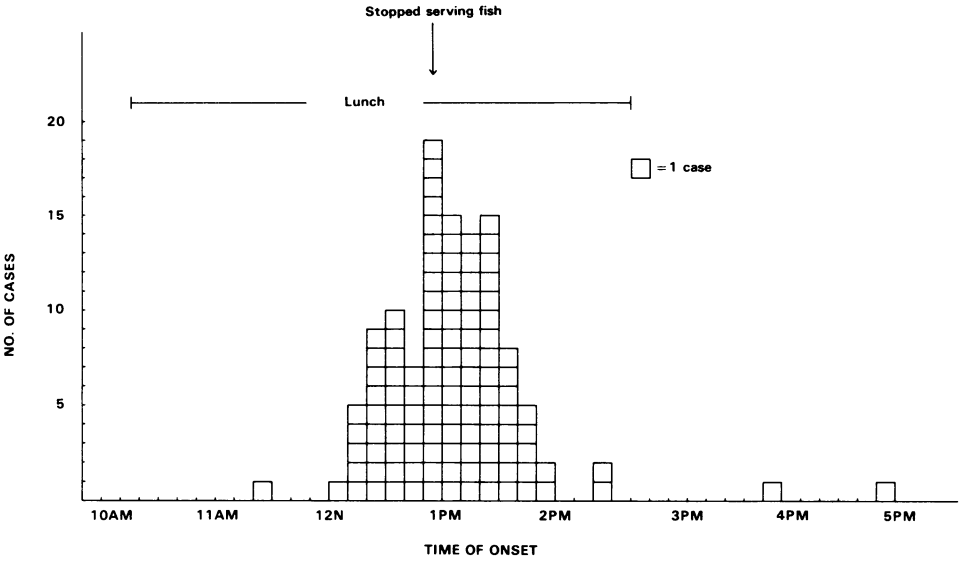

FIGURE 1—Time of Onset of Scombroid Fish Poisoning by 10-Minute Intervals for Store A Employees, July 4, 1986, Kaohsiung City, Taiwan

TABLE 2—Rates of Illness by Time Lunch Was Eaten

Time	No.	Ill	Well	% Ill
10:30 am–11:50 am	23	6	17	26%
11:50 am–12:30 pm	117	54	63	46%
12:30 pm–1:10 pm	88	55	33	63%

chi-square for trend = 11.32; $p < 0.001$

later for kitchen staff. These fish were found to contain histamine in a concentration of 10 mg/100 g. None of the cooked fish cooked and served to store A employees was available for testing.

In store B, fish were removed from the refrigerator at 9:00 am on July 4, cleaned, and boiled within one hour. None of store B employees became ill. No leftover fish from store B was available for laboratory testing.

Discussion

The U.S. Food and Drug Administration has established 50 mg/100 g as the hazard action level for histamine in tuna. In most outbreaks of scombroid poisoning, the histamine concentration in fish is greater than this level; however, outbreaks have been reported in which the concentration was <20 mg/100 g.[5] The level of histamine found in fish from this outbreak was low (10 mg/100 g); however, the fish tested may not be representative of the histamine level in the fish actually eaten by ill employees, since the fish available for testing had been placed back in the refrigerator at 10:00 am and therefore stood at room temperature (about 30°) about two-to-three hours less time than the fish eaten. Toxin production was apparently occurring at a rapid rate at room temperature since employees who ate from 12:30 to 1:10 pm had a much higher attack rate than those who ate one or two hours earlier.

It appears threshold toxic levels of scombrotoxin were reached in this outbreak after fish were stored only three to four hours at room temperature; fish from the same catch stored at room temperature for only one hour did not cause illness in store B employees. Although scombroid toxins are known to be quite heat-stable, the method of cooking in the two stores was different (frying versus boiling) and we wondered if heat penetration or moisture content could have affected toxicity. We could not find any reference relating toxicity to cooking method in the literature, however.

The time required to produce clinically significant levels of histamine in fish varies and is affected by the quantity and strain of bacterial contamination, storage temperature, and species of fish.[1,4] In laboratory studies of histamine production in fish stored at room temperature, six or more hours were usually required to reach levels that would be considered toxic.[6] We conclude from our investigation that clinically significant levels of scombroid toxin may be produced at room temperature more rapidly than previously published reports indicate. Whether this is due to some unusual feature of the contaminating microorganism, or to some property of the species of fish in this outbreak, or a combination of these factors, is unknown.

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