



Food poisoning caused by scombroids: A case-control study

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ABSTRACT

The aim of this study is to report the epidemiological characteristics of a food poisoning outbreak due to scombroid fish in a hospital. A case-control study (1:4) was conducted. Patients either symptomatic of food poisoning (cases) or asymptomatic (controls) eating at the hospital cafeteria were included. To identify the source of the outbreak, sanitary control factors were assessed. Microbiological studies and the mast cell tryptase test were performed. All cases and controls received a questionnaire enquiring about symptoms and foods consumed. The odds ratios (OR) for all risk factors and their 95% confidence intervals (CI) were assessed. In total, 20 individuals (90% female) were included in the study: four cases and 16 controls. The overall mean age was 43 years (SD: 10.2). The most frequent symptom observed was facial and neck erythema (100%). Microbiological cultures were negative, the mast cell tryptase test was normal and breakdown of the cold chain did not occur. The most likely source of the outbreak was fried anchovies (OR: 34.7; 95% CI: 1.50–809.6; $p=0.02$). Methods suitable to the rapid assessment of the outbreak allowed us to establish prompt preventive measures and identify the likely aetiology.

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Introduction

Food poisoning due to the consumption of fish and shellfish carries significant morbidity, with mussels, scombroids and Ciguatera the most frequently involved seafoods [1,2]. Food poisoning after the consumption of fish from the family Scombridae is the most common food poisoning involving fish worldwide [3] and it includes fish commonly consumed such as tuna, herring, sardines, anchovies, mackerel and bonito. The poisoning occurs by the ingestion of fish contaminated by histamine [4,5]. The usual clinical presentation is an allergic reaction that appears between a few minutes and a few hours after ingestion. The simultaneous appearance of such clinical manifestations in several patients may lead to the source of the outbreak [6].

The objective of our study was to describe the epidemiological characteristics of food poisoning by scombroids produced by

the consumption of fish in poor condition and the epidemiological methodology employed to identify the aetiology of the outbreak.

Methods

Design

We investigated the outbreak through a case-control study.

Setting

The Preventive Medicine Unit at our hospital received a report regarding the emergency room assessment of three patients the previous day with various symptoms and signs including facial erythema, tachycardia, rash, nervousness and hives. Their common link was that they ate at the hospital's cafeteria the day before.

Epidemiological investigation

The three symptomatic patients were interviewed. An epidemiological case was defined as any patient who had eaten in

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the cafeteria and presented with three or more of the aforementioned symptoms in the subsequent 2–3 h. A control was defined as anyone who had eaten in the hospital cafeteria on the same day but showed no symptoms. An active search was performed for cases and controls. One additional case and 16 controls were found, thus enabling a 1:4 case-control study. A food survey was administered to all cases and controls selected. Samples of all food dishes served were obtained under aseptic conditions (after hand hygiene and using sterile gloves) and processed in sterile vials. A microbiological study was performed consisting in a macroscopic inspection looking for parasites and the samples were cultured, after a basic Gram staining, in a Mueller-Hinton blood agar medium for aerobes and a Schaedler agar for anaerobes. The sanitary conditions of the facilities (cleaning of surfaces and food aspect) and staff (hand hygiene practices and use of gloves and caps) were evaluated and the traceability of the food and cold chain were reviewed. Available serum from only one case patient was processed to analyse the presence of tryptase because it was the only patient remaining at the emergency room when we carried out the study.

Statistical analysis

Qualitative variables were described by their frequency distribution and compared using the Fisher's exact test. Quantitative variables were described by their means and standard deviations and compared using the Mann-Whitney test. The risk of presenting with symptoms and possible causal factors was studied by the odds ratio (OR) and its 95% confidence interval (CI). The statistical analysis was performed using the program SPSS (v22.0, SPSS, Inc). Differences with $p < 0.05$ were considered statistically significant.

Results

A total of 20 subjects, four cases and 16 controls, were included in the study. Of the total subjects studied, 90% ($p < 0.05$) were women and the global average subject age was 43 years (SD: 10.2), 38.5 years (SD: 9) for cases and 51.3 for controls (SD: 12.7) ($p < 0.05$).

Table 1

Description of foods consumed and evaluation of foods as symptom risk factors.

Food	Odds ratio	95% CI ^a	p
Anchovies	34.7	1.50–809.6	0.02
Potato chips	2.1	0.28–15.9	0.85
Fillet	0.9	0.10–7.86	0.62
Steak	1.9	0.19–18.9	0.96
Grilled chicken	0.9	0.10–7.86	0.62
Scramble	0.9	0.10–7.86	0.52
Scallopini	11.4	0.53–246.7	0.62
Gazpacho	0.3	0.03–3.93	0.78
Stir fry	4.3	0.42–44.4	0.46
Macaroni	3.2	0.14–12.6	0.86
Salad	1.4	0.11–19.2	0.87
Cream puffs	0.8	0.06–8.9	0.46
Pie	1.7	0.18–15.6	0.97
Rice pudding	3.4	0.28–41.7	0.76
Custard	4.3	0.42–44.4	0.47

^a Confidence interval.

The most frequent symptoms in the case group were the following: facial and neck erythema (100%), tachycardia (75%), rash (75%), nervousness (75%) and hives (75%).

Samples of all the foods served (Table 1), environment and staff were cultured for microbiological studies, all of which provided negative results and their traceability revealed no alterations in the cold chain. The review of the hygienic conditions of the facilities was normal. Serum tryptase value in the one patient case from whom serum was available was normal.

The only food related to the symptoms was the ingestion of fried anchovies (OR: 34.7; 95% CI: 1.50–809.6; $p = 0.02$) (Table 1) and the hourly epidemic curve is shown in Fig. 1.

Discussion

The attack rate in our study was 57%. Of the seven subjects who ate fried anchovies four were affected and presented clinical manifestations [7]. Not all subjects who ate fried anchovies were affected. We are unsure whether other co-morbidities, gender or the consumption of medication might have influenced which subjects became ill [8]. The concentration of histamine may vary in different areas of the affected tissues, which might explain why

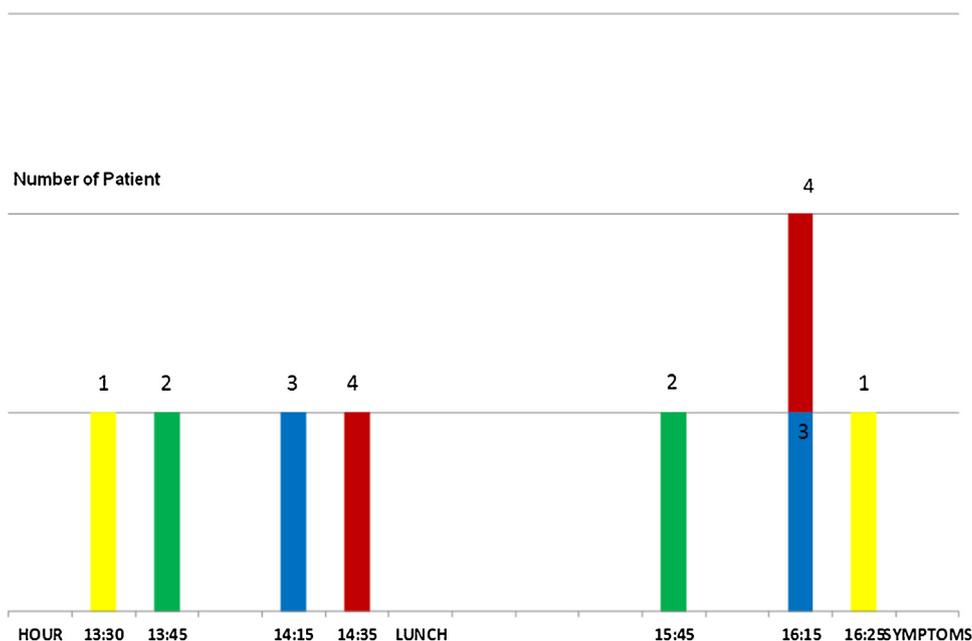


Fig. 1. Hourly epidemic curve.

some individuals who ate fish did not become ill [9]. The fish traceability records were registered and properly followed. No break in the cold chain occurred at any time, nor did any incidents in the fish handling, preparation or preservation occur.

An attempt was made to rule out anaphylaxis [10] and confirm the hypothesis of poisoning by performing tryptase tests on ill and control study cases; however, the serum available from only one symptomatic patient yielded a negative result. It supports our hypothesis because endogenous histamine release by mastocytes yields positive results. Nonetheless, we believe that the epidemiological evidence regarding the aetiology of the poisoning supports the consumption of fried anchovies as the most likely cause of the outbreak and the only seafood served that could contribute to scombroid poisoning were anchovies. Therefore, the recommendations were to discard the remaining refrigerated anchovies, exercise hygiene and food handling measures and review and evaluate purchases and suppliers. All patients experienced mild symptoms and recovered well.

Preventing food poisoning by scombroids requires a multidisciplinary intervention [3,11] and once cases appear, a rapid response to investigate the cause and implement necessary urgent measures is very important. To accomplish this outcome, case-control studies are particularly useful because they allow causality assessment with high scientific evidence and are rapid and relatively inexpensive to perform.

One possible limitation of our study may be the small sample of study subjects. Only four patients were identified and we found 16 controls to design a 1:4 case-control study, which increased the study power. The fact that we could not study the fish histamine concentration may also be a limitation. However, the epidemiological evidence support the hypothesis of fish contamination as the most likely aetiology [12].

In conclusion, outbreaks of food poisoning by scombroids are often not reported in our setting unlike others [2]. We present a methodology for their urgent evaluation with a high level of scientific evidence. The rapid action and evaluation of the situation allowed us to execute prompt preventive measures and identify the possible aetiology.

Funding

No funding resources.

Competing interest

None declared.

Ethical approval

The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008. The study was approved by the Alcorcon Foundation University Hospital (AFUH) Ethics Committee and Research Board.

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