An outbreak of gastrointestinal illness associated with the consumption of escolar fish

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Abstract

An outbreak of gastrointestinal illness occurred amongst attendees of a conference lunch in the Hunter area, New South Wales, in October 2001. A distinctive symptom reported by many ill persons was the presence of oily diarrhoea. The Hunter Public Health Unit investigated the outbreak by conducting a telephone interview of the cohort of conference attendees using a standard questionnaire. Twenty persons out of 44 attendees (46%) became ill following the conference. The median incubation period was 2.5 hours (range 1–90 hours). The most common symptoms reported were; diarrhoea (80%) — 38 per cent of these reported oily diarrhoea; abdominal cramps (50%); nausea (45%); headache (35%) and vomiting (25%). For analyses, a case was defined as a person who developed oily diarrhea, or diarrhoea within 48 hours, or had at least two other symptoms of gastroenteritis within 6 hours, of the conference lunch. Seventeen persons had symptoms that met the case definition. None of the foods or beverages consumed were significantly associated with illness, however, all cases had consumed fish and none of those who did not eat fish (4 persons) became ill. Moreover, only 'fish' or 'potato chips' could explain a significant proportion of the illness. Analysis of the oil composition of the fish consumed was consistent with the known profile of the species marketed as 'escolar'. Among those who consumed fish the following potential risk factors did not have a significant association with the illness: Body Mass Index, age, health status and the amount of fish consumed. We concluded that consumption of fish within the marketing group escolar can cause severe abdominal cramping, nausea and vomiting, in addition to incontinent diarrhoea. *Commun Dis Intell* 2002;26:441-445.

Keywords: fish, outbreak, diarrhoea, Australia, escolar, rudderfish, wax ester

Introduction

Purgative properties are reported for members of the escolar (*Lepidocybium flavobrunneum, Ruvettus pretiosus*) and rudderfish (*Centrolophus niger* and *Tubia* species) marketing groups.[1] Escolar are commonly sold in the domestic market mislabeled as 'rudderfish' or 'butterfish'. Their oil profiles have been found to be very distinctive from each other and other fish species.[2] Studies have found that both escolar and rudderfish have higher oil composition in proportion to their wet mass (2–25%[2]) than most seafood, but it is the high wax ester content in escolar oil (>90%[2]) that explains the purgative property.[2,3] In humans, wax esters accumulate in the rectum causing oily diarrhoea.[3] In October 2001, the Hunter Public Health Unit received a report of diarrhoea from a person who had attended a conference lunch at a local catering centre. Further investigation identified a number of conference attendees who had developed gastrointestinal illness after attending the conference lunch where the main meal was reported to be rudderfish. The Public Health Unit investigated the outbreak with the aim of preventing further cases of gastrointestinal illness and identifying the causative agent.

Methods

Epidemiologic investigation

The Public Health Unit conducted a cohort study of all conference attendees who attended the lunch. A list of conference attendees was obtained from the conference organisers and an effort was made to contact the entire cohort by telephone. A standard questionnaire was used to obtain information on the type and quantity of food and beverages consumed. Detailed information on clinical symptoms and duration of symptoms were also collected. In addition to the standard questions the study incorporated questions related to the use of medication, health status, height and weight and description of build that could be used to examine

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the impact of other factors on illness. Body mass index (BMI) was calculated for each interviewee (weight/height^2).

Relative risks (RR) with 95 per cent confidence intervals (95% CI) were calculated to estimate measures of association between exposure and illness. To further investigate factors associated with being a case, logistic regression analysis was performed, using BMI, age, health status and the amount of fish consumed as covariates. For the logistic regression analysis BMI and age were both categorised into 2 groups with the mean as the cut off. Statistical analysis was performed using Epi Info version 6.04c and SPSS version 11.0.

For the purpose of the analysis a case was defined as a person who developed oily diarrhoea, or diarrhoea within 48 hours, or suffered at least 2 symptoms that included; nausea, abdominal cramps, vomiting or headache within 6 hours of eating at the conference lunch. Diarrhoea was defined as three or more loose stools in 24 hours.

Environmental and laboratory investigations

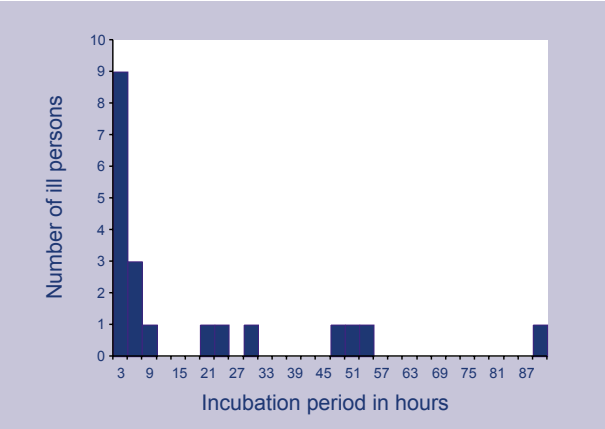
Hunter Public Health Unit Food Surveillance Officers inspected the fish market and lunch venue and reviewed food preparation and handling procedures. Two remaining pieces of fish from lunch and a sample of the oil in which it was cooked were sent to the CSIRO Marine Research Laboratory, Hobart, Tasmania, for oil content and composition analysis and possible identification of the species. The methods of analysis involved the extraction of oil with solvents and the determination of individual oil classes using an Iatroscan thin-layer chromatograpgy-flame-ionization detector (TLC-FID) analyzer, and is reported elsewhere.[2]

Results

Public Health Unit officers interviewed 94 per cent (44/47) of persons who ate at the conference lunch. Of these, 46 per cent (20/44) reported gastrointestinal symptoms (Table 1). The male to female ratio for persons reporting gastrointestinal symptoms was 1.2:1. The median duration of illness was 22 hours (range 5–78 hours). The most frequent symptom reported was diarrhoea (16/20), which was also reported as the most severe symptom by 89 per cent of ill persons. Thirty-eight per cent of persons with diarrhoea described the diarrhoea as oily.

The median time between lunch and onset of illness was 2.5 hours (range 1–90 hours) (Figure). Symptoms of abdominal cramping, vomiting, nausea and headache, generally proceeded diarrhoea (Table 1). Fifty-six per cent (9/16) of persons with diarrhoea reported additional symptoms, which included abdominal cramping (8/9), nausea (6/9), vomiting (3/9) or headache (4/9). Thirty-five per cent of ill persons could not perform their normal activities for a median of 2 days (range 0.5–5 days), however no one sought medical attention.

Figure. Incubation period of illness reported by persons who attended a conference lunch, Hunter, New South Wales, 2001



Seventeen ill persons (17/20) met the case definition and were included in the analysis. Of the 3 ill persons who did not meet the case definition, two had watery diarrhoea more than 48 hours after the lunch and one did not have diarrhoea but had other symptoms more than 6 hours after lunch. Food specific attack rates for cases showed that consumption of 'fish' or 'potato chips' could explain a significant proportion of the illness (Table 2). There were no cases who did not eat the fish and everyone consumed approximately the same amount of fish. No other foods or beverages showed a statistical association with illness.

Logistic regression analysis was performed on data from persons who ate fish. BMI was calculated for 39 interviewees. The mean BMI for cases was 25.8 (SD 3.2) and non-cases was 26.8 (SD 6.5). The results showed that cases and non-cases did not differ by BMI, age or health status.

Table 1. The prevalence of various symptoms among the persons who reported illness after attending a conference lunch, Hunter, New South Wales, 2001

Symptom	Prevalence (%) n=20	Median incubation period
Diarrhoea — watery only	50	4 hours (range 2–90 hours)
Diarrhoea — oily	30	4 hours (range 2–90 hours)
Abdominal cramps	50	2 hours (range 1–53 hours)
Nausea	45	2 hours (range 1–6 hours)
Headache	35	2 hours (range 1–27 hours)
Vomiting	25	2 hours (range 1–2 hours)

Table 2. Food-specific attack rates among persons who attended a conference lunch, Hunter, New South Wales, 2001

Food items	Persons who consumed item		Persons who did not consume item		Relative risk	95% CI
	Total ill	Attack rate (%)	Total ill	Attack rate (%)		
Fish	17/40	43	0/4	0.0	Undefined	Undefined
Potato chips	17/39	44	0/5	0.0	Undefined	Undefined
Apple slice	2/8	25	15/34	44	0.6	0.6–2.0
Coconut slice	2/3	67	15/40	38	1.8	0.7–4.4
Curried egg	3/7	43	13/33	39	1.1	0.4–2.8
Honeydew	1/10	10	16/32	50	0.2	0.0–1.3
Kiwi	2/9	22	15/34	44	0.5	0.1–1.8
Other foods	7/12	58	10/32	31	1.9	0.9–3.8
Pineapple	2/4	50	14/35	40	1.3	0.4–3.6
Rockmelon	6/16	38	11/27	41	0.9	0.4–2.0
Vanilla slice	3/7	43	14/37	38	1.1	0.4–2.9
Watermelon	4/17	24	13/26	50	0.5	0.2–1.2

Table 3. Oil content and composition of fish samples from the outbreak, Hunter, New South Wales 2001, compared with that of escolar and rudderfish reference specimens[2]

Oil content and composition		Fish samples from outbreak		Reference specimens[2]	
		Sample 1	Sample 2	Escolar species	Rudderfish species
Oil content (% of wet body mass)		21.7	22.4	17.8–21.2	1.7–24.8
Oil composition (% in oil)	Wax ester	96.4	97.6	90.1–96.9	n.d. – 1.5
	Triglyceride	1.9	0.3	n.d. – 1.5	0.3–14.9
	Free fatty acids	n.d.	n.d.	n.d. – 0.7	0.6–21.6
	Polar lipids	1.7	2.1	2.1–5.7	1.3–42.1
	Hydrocarbon	n.d.	n.d.	n.d. – 1.1	n.d. – 93.4
	Diacylglyceryl ether	n.d.	n.d.	n.d. – 0.5	2.2–92.5

n.d.= not detected

Environmental and laboratory investigations

No breach of food preparation and handling procedures was detected. The results of the analysis of oil content and composition of the fish showed that the fish samples had oil content of 22 per cent (percentage of weight), which is in excess of the average Australian marine fish oil content of 1 per cent[1,2] and 97 per cent of the oil content was wax ester (Table 3). These results are consistent with the oil content of members of the escolar marketing group (*Lepidocybium flavobrunneum, Ruvettus pretiosus*),[2,4] and suggest that the fish served at the conference meal were escolar, and not rudderfish, as shown on the sale invoice to the catering venue.

Discussion

The investigation identified an outbreak of gastrointestinal disease caused by the consumption of escolar. Escolar has been described as having a purgative effect due to the high wax ester content in the oil of the fish accumulating in the rectum causing oily diarrhoea. In this outbreak we identified the effects of escolar consumption to involve more severe symptoms of gastrointestinal illness, including diarrhoea, nausea, headaches, abdominal cramps and vomiting. It is unclear why some people who consumed fish became ill and some did not. In this investigation BMI, age, health status and the amount of fish consumed did not affect the outcome.

There is a paucity of information describing the symptoms associated with escolar consumption and as a result it may be an under-recognised cause of gastrointestinal disease. The health effects of the consumption of escolar are not well described in literature. Berman *et al* (1981)[3] distinguished the effects of wax ester from hydroxyoleic acid, which is the purgative element in castor oil. They claimed that consumption of wax ester resulted in a passing of accumulated oil in the rectum, while consumption of the hydroxyoleic acid caused diarrhoea by some irritant effect on the bowel. Therefore, they proposed to label the diarrhoea caused by escolar as keriorrhoea, a Greek word to mean flow of wax. However, this suggestion was based on symptoms described by only two cases. We found that cases suffered not only the inconvenience of incontinent diarrhoea, but also abdominal cramps, nausea, headache and vomiting.

While BMI, age and health status and amount of fish consumed were not associated with illness, there are other factors that could mediate the severity and occurrence of the gastrointestinal effects of reported escolar consumption. These factors include variability in wax ester content of different fillet cut depths and mixing of fillets from different fish species sold as ‘rudderfish’ at the wholesale or retail levels. These may result in differential exposure in a cohort of consumers.

A limitation of this study was that we did not collect stool samples for microbiological analysis from those who were ill because 4 days had lapsed before the event was reported. In the absence of any stool samples from ill persons, we could not rule out that the illness was caused by an infectious pathogen. Toxicity such as histamine poisoning from fish is not a likely explanation, as the onset is more rapid (45 minutes) than the incubation period observed in this outbreak and symptoms differ as histamine poisoning symptoms usually include fever, flushing and rapid pulse rate.[5] The lack of illness among those who did not consume the fish did not allow a relative risk to be calculated, however consumption of 'fish' or 'chips' explained the highest proportion of the illness reported. Potato chips are not a plausible cause of the illness. Although glycoalkaloids found in potatoes can cause illness, the oral dose required for such effects is higher than would be expected from a serve of potato chips[6] and neurological disorder was not reported by members of the cohort. In this study potato chips have a strong correlation with consumption of fish. Dose response could not be assessed from this study, as there was little variation in the amount of fish consumed by each person.

This investigation highlights the need for escolar hazard guidelines to protect both traders and the public. There may be a number of restaurateurs and caterers that are unaware of the potential health effect of escolar. Escolar, a deep-sea fish of the tropical and temperate oceans, is harvested by long line trawlers from southern Queensland, along the south of the continent and up the Northwest Shelf of Western Australia.[1] In New South Wales, more than 60 tonnes of fish is marketed annually under the label of 'rudderfish' at one auction house alone (Sydney Fish Market, Information Sheet, 17 August 2001). In Japan, the Ministry of Health prohibits the sale of the two species of escolar.[4] In its 1998 hazard guide, the United States of America Federal Drug Administration recommended that *Lepidocybium flavobrunneum* not to be marketed in interstate commerce.[7] There may be a need for greater education of fish wholesalers and retailers to prevent future outbreaks. Our investigation also highlighted that selling escolar as 'rudderfish' may indicate a breakdown in quality control in the fish industry. It is important to correctly identify species at the wholesale level to ensure that only species suitable for human consumption are sold. The Department of Agriculture, Fisheries and Forestry — Australia is currently addressing this issue. In April 2002 its committee for seafood marketing names made recommendations for public consultations aimed at resolving existing misidentification and mislabeling of escolar and rudderfish.

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