

Short reports

SHORT INCUBATION PERIODS IN *CAMPYLOBACTER* OUTBREAKS ASSOCIATED WITH POULTRY LIVER DISHES

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Introduction

Campylobacter is the most common cause of bacterial gastroenteritis in Australia.¹ The incubation period is usually between 2 and 5 days but can range from 1 to 10 days.² Symptoms include diarrhoea (often bloody), fever and abdominal pain, and can persist for 7 days or longer.² The infective dose required to cause illness is as low as 500 organisms.^{3,4} Despite a high number of notifications, outbreaks caused by *Campylobacter* are uncommonly detected.^{3,5-7}

Outbreaks of *Campylobacter* have regularly been associated with poultry and dairy products, and in recent years the number of outbreaks associated with poultry liver dishes has increased in the United States of America and the United Kingdom.^{5,6,8}

This article describes a point source outbreak of *Campylobacter* associated with duck liver parfait with a possible short incubation period; and the review of the literature prompted by the investigation, which identifies short incubation periods as a common feature of point source outbreaks associated with poultry liver consumption.

Methods

OzFoodNet in Hunter New England was contacted in September 2013 with a report of gastroenteritis amongst guests who attended a wedding reception. A retrospective cohort study was conducted amongst the guests. A standardised questionnaire was completed telephonically by trained interviewers.

A case was defined as any person who consumed food and/or beverages at the wedding who had diarrhoea within 7 days of attending the wedding.

Data analysis was conducted with STATA 11. Univariate analysis included attack rates, *P*-values, relative risks and 95% confidence intervals.

The NSW Food Authority conducted an inspection of the implicated premises. Although there was no food left-over due to the late notification of the outbreak (35 days after the event), information on ingredients and cooking processes of foods served was obtained.

A literature review was conducted using the search term 'campylobacter' in combination with 'poultry', 'duck', 'chicken' or 'liver'. An extract of outbreaks associated with poultry liver (chicken or duck) was obtained from the Australian OzFoodNet outbreak register. Incubation times recorded in hours were converted to days to 1 decimal point.

This outbreak investigation was conducted under the *NSW Public Health Act 2010* and thus ethics approval was not required.

The outbreak

Contact details were available for 33 of the 50 guests, 30 (91%) of whom completed the questionnaire and 17 met the case definition. The median incubation period was 24 hours (range 5–60 hours) and 12 cases reported an incubation period of less than 24 hours. All cases reported diarrhoea, 12 had abdominal pain, nine had fever, seven had nausea and three had vomiting. The median duration of illness was 6 days. One case was hospitalised. One faecal sample was obtained, which was positive for *Campylobacter jejuni*. The incubation period for the confirmed case was 2 days.

In a univariate analysis, the only significant association with illness was for the consumption of the entree that contained duck liver parfait (relative risk 4.3, 95% confidence intervals 1.2–15.5). Fifteen of the 17 (88.2%) cases ate the duck entrée.

The environmental investigation indicated that the duck liver was cooked to a maximum internal temperature of less than 70°C. No food samples were available for testing. No illness was identified in staff or in guests attending other functions at the implicated venue.

Review of *Campylobacter* outbreaks associated with poultry liver dishes

Eight published outbreak reports and 6 additional outbreak records from the OzFoodNet register were reviewed (Table). The median incubation period for *Campylobacter* outbreaks associated with poultry liver in these outbreaks was typically about 2 days, with individual incubation periods ranging from less than 1 day to 9 days. The incubation period for the 1st confirmed case was available for 9 outbreaks, of which 4 (44%) reported an incubation period of less than 1 day.

Table: Characteristics of *Campylobacter* outbreaks associated with poultry liver

Vehicle	Jurisdiction	Number of cases	Number attending	Number confirmed <i>Campylobacter</i> only	Number confirmed <i>Salmonella</i> and <i>Campylobacter</i>	Median incubation (days)	Incubation range (days)	Incubation first confirmed case (days)
Chicken liver pâté	South Australia ⁴	15	57	3	0	2	0.3–6	<1
Duck liver pâté	United Kingdom ⁸	18	32	8	0	NA	0.5–3	<1
Chicken liver pâté	United Kingdom ⁹	59	175	5	3	2	0–6	<1
Chicken liver pâté	Australian Capital Territory	7	Unknown	3	0	1	0.5–3.8	<1
Chicken liver pâté	United Kingdom ¹⁰	49	102	22	0	2.3	0–5	1
Chicken liver parfait	United Kingdom ³	24	67	13	0	2.3	1–5	1
Duck liver pâté	United Kingdom ¹¹	45	77	4	0	2.8	0.4–8.4	1
Chicken liver pâté	Tasmania	44	Unknown	5	0	2	0.6–4.1	1.5
Duck liver parfait	New South Wales*	17	50	1	0	1	0.2–2.5	2
Chicken liver parfait	United Kingdom ¹²	11	26	4	0	2.5	0.7–7	NA
Chicken liver pâté	New South Wales	11	34	2	0	1.8	1.3–3.5	NA
Duck liver pâté	Western Australia	65	705	3	3	2.5	0.1–8.1	NA
Chicken liver pâté	Scotland ¹³	48	Unknown	15	0	2	0–9	NA
Chicken liver pâté	Queensland	4	Unknown	1	0	1.6	1.1–2.1	NA
Duck liver pan-fried	Queensland	2	Unknown	2	0	2.7	1–3.5	NA

NA Not available

* Current outbreak.

Discussion

This review indicates that short incubation periods are a common feature of *Campylobacter* outbreaks associated with poultry liver dishes. During this outbreak 12 (71%) cases indicated onsets within 24 hours of the function. The review of previous poultry liver related outbreaks indicated that 10 of 14 outbreaks (excluding the current outbreak) had a minimum incubation period of less than a day, with the shortest being 0.1 days. When analysis of the 1st case was limited to confirmed infection only, four of the 9 outbreaks had cases with an incubation period less than 1 day and three had an incubation period of 1 day.

Campylobacter infection in humans usually has a reported incubation period of 2 to 5 days, with some references indicating one to 10 days.² Due to the high levels of *Campylobacter* potentially present within liver, it is possible infected individuals may have a shorter incubation period due to a large dose.

During this outbreak investigation, it was clear that the internal temperature achieved during preparation of the liver dish was not adequate to kill *Campylobacter*. Poultry livers should be cooked for 2 to 3 minutes after they reach an internal temperature of 70°C.¹⁴ Inadequate cooking of chicken or duck livers has been associated with numerous *Campylobacter* outbreaks in Australia and internationally.^{4,5,8,10,11} Following a review of outbreaks linked to poultry liver dishes in Australia in 2011,¹⁵ Food Standards Australia New Zealand issued advice on the safe cooking of poultry livers.¹⁴ New Zealand studies have shown that *Campylobacter* contaminates both the external and internal tissue of livers and that inactivation of *Campylobacter* is proportional to cooking time.^{16–17}

Limitations

The outcome of the initial outbreak investigation that prompted this review is subject to potential recall bias as the investigation did not commence until 35 days after the function had occurred. As not all guests could be contacted (30 out of 50 were interviewed) the possibility of selection bias cannot be excluded.

Many of the outbreaks reviewed only obtained stool specimens from a small proportion of cases and thus the illness reported in some individuals may not have been due to *Campylobacter*. However, there were confirmed cases in previous outbreaks that had incubation periods less than 1 day. Some studies found cases with mixed infections of *Salmonella* and *Campylobacter*. *Salmonella* can have an incubation period as short as 12 hours,

and have similar symptoms, therefore it is possible the short incubation periods were the result of another infection rather than *Campylobacter* in some instances. Three of the outbreaks reviewed identified cases with mixed infection; two of these had incubation periods of less than 1 day.

Incubation periods of *Campylobacter* outbreaks associated with other food vehicles were not reviewed as part of this study. Therefore no comparison can be made with other food vehicles.

Conclusion

It is not uncommon to identify cases with short incubation periods (less than a day) in campylobacter point source outbreaks associated with poultry liver consumption. This may result from the potentially high infectious dose in liver. Investigators should not discount suspected gastroenteritis cases with short incubation periods when a poultry liver dish is implicated.

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