

A Food-Borne Outbreak of Streptococcal Pharyngitis

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Abstract

Background: Food-borne pharyngitis outbreaks causing substantial morbidity have been documented.

Objectives: To investigate an outbreak of food-borne Streptococcus beta hemolyticus group A pharyngitis among employees of a hitech company.

Methods: We received a report on an unusually high rate of morbidity among employees of a company in September 2003. The Tel Aviv District Health Office conducted an epidemiological investigation of the outbreak.

Results: Among the 278 people who attended a company party, 83 became ill. The overall attack rate was 29.8%. Information was available on 174 of 193 employees and family members who attended the party and worked in the Tel Aviv district. Forty-six of them became ill (attack rate 26.4%). The secondary attack rate was 3.8%. Most cases developed symptoms 24–48 hours following the event. Seven cases had throat cultures positive for Streptococcus beta hemolyticus group A. Three items were significantly associated with becoming sick: spring chicken (odds ratio 2.26, 95% confidence interval 1.11–4.63, $P = 0.02$), vegetable salad (OR 2.88 95%CI 1.40–5.94, $P = 0.003$) and corn (OR 7.73, 95%CI 3.18–18.80, $P < 0.001$). Eating corn remained significantly associated with pharyngitis after controlling for other food items consumed.

Conclusions: We describe the epidemiological investigation of a large food-borne outbreak of Streptococcus beta hemolyticus group A pharyngitis most probably transmitted by corn. No previous publication has implicated corn. Food handlers and the public should be aware that they can transmit diseases to others. Physicians should be aware that streptococcal pharyngitis could be a food-borne disease and that outbreaks in a non-confined setting may be easily missed.

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Droplet transmission is the most common mode of streptococcal pharyngitis propagation [1]. However, food-borne pharyngitis outbreaks causing substantial morbidity have been documented [1–8]. These outbreaks usually occurred in confined settings, such as an army unit, industrial plant, and prison [3–5,7,9], and others occurred after attending a social event, for example, a school banquet, wedding, and private party [2,6–9]. The attack rates ranged between 50% and 91% among people exposed to the contaminated food [1]. Food handlers who harbor the bacteria in their pharynx or in skin lesions were the main source of those

epidemics, and cold salads were often the vehicle of transmission [1–4].

The characteristics of food-borne streptococcal pharyngitis outbreaks are abrupt onset and low complication rate compared with airborne epidemics [1]. Prompt diagnosis, immediate isolation of patients, and antibiotic treatment are imperative for the prevention of secondary spread and complications [1]. However, caregivers are often unaware of this mode of transmission of streptococcal pharyngitis, and outbreaks in a non-confined setting can be easily missed.

We report an outbreak of food-borne streptococcal pharyngitis among employees of a company who worked at different sites but attended a common social event.

Patients and Methods

The Tel Aviv District Health Office is responsible for conducting epidemiological investigations of unusual morbidity or disease outbreaks in the Tel Aviv district. The report of an unusual number of company employees feeling unwell was first received in September 2003. Approximately 50 workers and family members were suffering from a sore throat and fever. All symptoms began shortly after attending the company party that took place 10 days prior to the report.

Epidemiological investigation began on the same day the report was received. Initially, an investigating team went to the company offices in the Tel Aviv district and interviewed the workers. Additional interviews were conducted by telephone. In both cases the interviews were conducted with a standard questionnaire. The questionnaire included questions on demographic characteristics, food items consumed, time of onset of the first symptoms, symptoms and signs of the illness, and information on household members and their health. The company employees worked at various sites.

Since the maximal incubation period of streptococcal pharyngitis is considered to be 4 days, primary cases were defined as those who attended the party and suffered from a sore throat with or without fever within the subsequent 4 days. Secondary cases were defined as those who became ill more than 4 days after the party.

Throat cultures were taken from three employees of the catering company that had supplied the food for the party. Throat cultures from the cases were taken by their family doctors.

OR = odds ratio
CI = confidence interval

Statistical analysis

By using the SPSS version 14.0 software, the chi-square test compared between the proportion of cases and controls consuming each food item served at the party. Continuous variables were compared using Student's *t*-test. $P < 0.05$ was considered statistically significant. Odds ratios and 95% confidence intervals were calculated for each food item. Those items that were statistically significant by univariate analysis were included in a logistic regression model.

Results

The epidemiological investigation

Overall, 278 people attended the party, of whom 83 became ill. The overall attack rate was 29.8%. Of the 278 people who attended the party, 193 were employees (and their family members) who worked in the Tel Aviv district. Information was available on 174 of the 193 attendees (90.2%). Forty-six of them (19 employees and 27 family members and friends) became ill following the event (attack rate 26.4%). The attack rate was similar for males and females (29.3 and 23.1 respectively, $P = 0.36$).

The mean age of the participants at the party was 22.1 ± 13.9 years (range 1–71 years). Those who became ill were significantly older than those who did not (29.5 ± 13.1 vs. 19.5 ± 13.3 years, $P = 0.001$).

The epidemic curve is shown in Figure 1. Thirty-one cases developed symptoms 24–48 hours after the party, which suggests a common source outbreak. Six cases developed symptoms 72–96 hours after the party. The mean incubation time for the primary cases was 1.79 ± 0.94 days.

Secondary cases

Five individuals became sick 5–9 days after the party and were considered to be secondary cases, giving a secondary attack rate of 3.8% (5 of 133). On day 5 the son of an employee who attended the party became ill. His mother and sister had become ill on day 2 and 3 respectively. On day 7 an employee, whose husband attended the party and became ill on day 4, developed a sore throat with no fever. On day 8 another employee's husband developed a sore throat with no fever. His wife and daughter attended the party but did not become ill. He did not seek medical attention. On day 9 another couple that attended the party became ill. Their family members attended the event and became ill a few days earlier (on days 2 and 4). The wife had a throat culture positive for *Streptococcus A* and she was

treated with antibiotics. The husband did not seek medical attention.

Symptoms

The main symptoms and signs reported were sore throat (100%), weakness (84.8%), fever (73.3%) and enlarged cervical lymph nodes (54.5%). The mean temperature recorded (in 25 individuals) was $39.3 \pm 0.8^\circ\text{C}$ (range 38.0 – 41.0°C). Less common complaints were chills (47.8%), dizziness (30.4%), muscle pain (37.0%), abdominal pain (23.9%), diarrhea (19.6%), nausea (17.4%) and vomiting (10.9%).

Throat cultures

Throat cultures were taken from seven cases by their family doctor (four employees and three family members). These cultures were positive for *Streptococcus beta hemolyticus* group A. Unfortunately, none of them was available for typing at the time of investigation. All cultures from the three catering workers were negative for *Streptococcus* group A.

Association between food items consumed and morbidity

The food items served at the party included chicken, spring chicken, lamb, hotdogs, bread, hummus, vegetable salad, cabbage salad, tomato salad, hot corn on the cob, roasted vegetables, Belgian waffle, chocolate syrup, maple syrup, and cold drinks. At the time of the investigation no food items were available for bacteriological examination since the report on the illness was received 10 days after the event. Odds ratios and 95% confidence interval for each food item consumed (primary cases) are listed in Table 1. Three items were significantly associated with becoming sick: spring chicken (OR 2.26, 95%CI 1.11–4.63, $P = 0.02$), vegetable salad (OR 2.88, 95%CI 1.40–5.94, $P = 0.003$) and corn (OR 7.73, 95%CI 3.18–18.80, $P < 0.001$). The attack rate among those who ate corn was 41.0% compared with 8.2% among those who did not eat corn. When primary cases with documented high temperature were compared with controls (healthy people), the association with corn consumption was even stronger (OR 39.0, 95% CI 5.08–299.27, $P < 0.001$).

In order to examine the possibility that the relationship between eating spring chicken and morbidity was associated with eating corn, the relationship between these two variables was

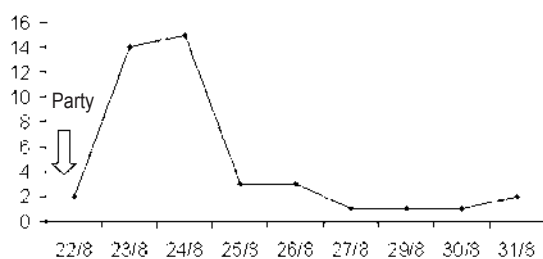


Figure 1. The epidemic curve, with the X axis indicating the date and the Y axis the number of patients.

Table 1. Odds ratios and 95% confidence interval for food items consumed by primary cases and controls

Food item	Cases N (%)	Control N (%)	P	OR	95%CI
Chicken	14 (34.1)	42 (33.3)	0.92	1.04	0.49–2.18
Spring chicken	22 (53.7)	43 (33.9)	0.02	2.26	1.11–4.63
Lamb	14 (34.1)	46 (36.2)	0.81	0.91	0.44–1.91
Hot dogs	20 (48.8)	61 (48.0)	0.93	1.03	0.51–2.08
Hummus	13 (31.7)	36 (28.3)	0.68	1.17	0.55–2.52
Vegetable salad	23 (56.1)	39 (30.7)	0.003	2.88	1.40–5.94
Cabbage salad	8 (19.5)	14 (11.0)	0.16	1.96	0.76–5.07
Corn	34 (82.9)	49 (38.6)	<0.001	7.73	3.18–18.80

Table 2. Multivariate logistic regression model for the relationship between consumption of vegetable salad, spring chicken and corn and morbidity

	P	OR	95%CI
Vegetable salad	0.048	2.34	1.008–5.42
Spring chicken	0.506	1.33	0.57–3.09
Corn	<0.001	7.16	2.90–17.68

assessed. We found that those who ate spring chicken tended to eat corn (OR 2.01, 95% CI 1.07–3.78, $P = 0.029$). We did not find the same relation between corn and vegetable salad.

The three food items found to be statistically significant in the univariate analysis (spring chick, vegetable salad and corn) were analyzed in a logistic regression model. Eating corn remained significantly associated with illness after controlling for other food items consumed (OR 7.16, 95%CI 2.90–17.68, $P < 0.001$). Borderline significance was observed with vegetable salad (OR 2.34, 95%CI 1.008–5.42) [Table 2]. Further investigation revealed that the corn, which was served in the form of corn on the cob, had been prepared at the location of the event and had been served in a large bowl filled with lukewarm water. The diners removed the corn from the bowl themselves.

Food preparation facilities

The catering company consists of four cooks. An inspection of their facilities revealed inadequate sanitary conditions, including dirty storage areas, proximity of raw and cooked food, presence of expired food items, and inappropriate vehicles for food transport.

Discussion

We described the epidemiological investigation of a large outbreak of streptococcal pharyngitis. The attack rate was 26.4% and the secondary attack rate 3.8%. The epidemic curve was typical of common source outbreak, supporting the assumption that exposure was at the party held for the company employees. We suspect that a particular food item (corn) was the source of the outbreak.

The causative organism was confirmed in seven cases. The clinical presentation of the remaining patients mostly suggested pharyngitis, probably bacterial, although there was no laboratory confirmation.

A statistically significant association was found with eating corn. There were no food items available for bacteriological examination since notification was received 10 days after the party. No Streptococcus group A was isolated from the catering workers. It is likely that the method of serving the corn (a large bowl filled with lukewarm water) contributed to the spread of the pathogen.

Several reports have documented food-borne outbreaks of streptococcal pharyngitis. A food-borne outbreak of pharyngitis caused by group A beta-hemolytic Streptococcus occurred in an Israeli air force base in 1992 [4]. In that event 197 people

were infected by the consumption of white cheese that had been prepared without proper hand washing 24 hours before serving, and then served again after being stored at room temperature for 5 hours. Group A Streptococcus was cultured from the throat of a food handler who prepared the cheese. The secondary attack rate was 1.6% as compared to 3.8% in our study.

Another study demonstrated a food-borne outbreak due to group A beta-hemolytic streptococci type T12 in a military base in Israel in 1990 [5]. The epidemiological investigation indicated that the source of the outbreak was an egg salad served at lunch. One of the food handlers suffered from pharyngitis while preparing the eggs and the same type of Streptococcus that caused the outbreak was isolated from his throat. An outbreak of pharyngitis caused by group A Streptococcus in 34 persons attending a private anniversary party was described in New Hampshire [8]. Three food items were suspected of causing the outbreak: clam dip, onion dip and potato salad. A person who prepared or assisted in preparing these food items had been asymptomatic but had a close contact who had been ill with acute pharyngitis. An outbreak of tonsillopharyngitis caused by *Streptococcus pyogenes* occurred among inmates of a rural correctional center in Australia in 1999 [9]. A total of 72 inmates (28%) became ill (57 primary cases and 15 secondary cases), among whom 9 had positive throat cultures (5 from primary cases and 4 from secondary cases). The primary and secondary attack rates were 22% and 8%, respectively. One of the food handlers was found to harbor the bacteria in wounds on his hand and in his throat. The vector of the epidemics appeared to be curried egg salad sandwiches.

Most of the epidemics, including the one described here, occurred between April and August, suggesting an association with a warm ambient temperature that allowed the replication of the bacteria [1,4,11].

In a review article, the primary attack rate among persons who were exposed to contaminated food varied between 50 and 91% in different reports. The secondary attack rate was usually low [1]. In our study the overall attack rate was 26.4% and 3.8% among secondary cases.

Food-borne streptococcal pharyngitis has been associated with milk (before pasteurization), boiled eggs, potato and chicken salads [1,9]. To the best of our knowledge corn has not been previously described as a vehicle for transmission of streptococcal infection. A report from Italy demonstrated febrile gastroenteritis among students who were exposed to corn and tuna salad [10]. *Listeria monocytogenes* was isolated from a sample of the salad and the environment of the catering plant (work surfaces, utensils, sinks in the working area for the preparation of the salad, and floor drains).

It is mandatory that food handlers be aware that they can transmit diseases to the public. In addition, there should be no direct contact between the foods served and the diner's hands. In this report we found that the food handlers tested negative, suggesting that an infectious attendee at the party might have been ill or a carrier of the bacteria and transmission occurred from this person to other people in the event via corn.

Most of the published outbreaks of food-borne streptococcal

pharyngitis occurred in an institutional setting or following a social event. Additional outbreaks may be unrecognized when individuals are widely spread in the community [9]. In this study we report an outbreak among employees of a company who attended a social event but worked at different sites, therefore this outbreak could have easily been missed. Indeed, it took 10 days until a report was received by the company employees. This type of outbreak can occur more often and demonstrates the difficulty in assessing the true rates of food-borne streptococcal pharyngitis in the community. Medical personnel should be aware of the possibility of food-borne streptococcal pharyngitis. Prompt diagnosis, isolation of patients and initiating treatment can prevent the secondary spread of the disease as well as the prevention of complications, although not common, such as rheumatic fever and glomerulonephritis [1]. In a prospective study conducted in Israel, clinical symptoms among food-borne and air-borne streptococcal pharyngitis were compared [12]. The clinical presentation of food-borne streptococcal pharyngitis was more confined to the pharynx, including significantly higher frequency of sore throat, pharyngeal erythema, enlarged tonsils and sub-mandibular lymphadenopathy, but less frequently coryza and cough compared to patients with endemic air-borne streptococcal pharyngitis.

It is essential that the health district office be notified as early as possible in order to implement means of secondary prevention.

References

1. Katzenell U, Shemer J, Bar-Dayana Y. Streptococcal contamination of food: an unusual cause of epidemic pharyngitis (review). *Epidemiol Infect* 2001;127:179–84.
2. Farely TA, Wilson SA, Mahoney F, Kelso KY, Johnson DR, Kaplan EL. Direct inoculation of food as the cause of group A streptococcal pharyngitis. *J Infect Dis* 1993;167:1232–5.
3. Hill HR, Zimmerman RA, Reid GVK, Wilson E, Kilton RM. Food-borne epidemic of streptococcal pharyngitis at the United States Air Force Academy. *N Engl J Med* 1969;280:917–21.
4. Bar-Dayana Y, Bar-Dayana Y, Klainbaum Y, Shemer J. Food-borne outbreak of streptococcal pharyngitis in an Israeli airforce base. *Scand J Infect Dis* 1996;28:563–6.
5. Lossos IS, Felsenstein I, Breuer R, Engelhard D. Food-borne outbreak of group A beta-hemolytic streptococcal pharyngitis. *Arch Intern Med* 1992;152:853–5.
6. Gallo G, Berzero R, Cattai N, Recchia S, Orefici G. An outbreak of group A food-borne streptococcal pharyngitis. *Eur J Epidemiol* 1992;8:292–7.
7. Kaluski DN, Barak E, Kaufman Z, et al. A large food-borne outbreak of group A streptococcal pharyngitis in an industrial plant: potential for deliberate contamination. *IMAJ* 2006;8:618–21.
8. Horan JM, Cournoyer JJ. Foodborne streptococcal pharyngitis. *Am J Public Health* 1986;76(3):296–7.
9. Levy M, Johnson CG, Kraa E. Tonsillopharyngitis caused by food-borne group A streptococcus: a prison-based outbreak. *Clin Infect Dis* 2003;36(2):175–82.
10. Aureli P, Fiorucci GC, Caroli D, et al. An outbreak of febrile gastroenteritis associated with corn contaminated by listeria monocytogenes. *N Engl J Med* 2000;342(17):1236–41.
11. Tanaka D, Shima T, Isobe J, et al. Epidemiology and molecular analysis of group A streptococci from patients involved in food-borne disease outbreaks in Japan between 1996 and 2003. *Jpn J Infect Dis* 2006;59(3):202–3.
12. Bar-Dayana Y, Bar-Dayana Y, Shemer J. Food-borne and air-borne streptococcal pharyngitis – a clinical comparison. *Infection* 1997; 25(1):12–15.

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