Salmonella in Imported Mangos: Shoeleather and Contemporary Epidemiologic Techniques Together Meet the Challenge

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(See the article by Sivapalasingam et al. on pages 1585–90)

In this issue of Clinical Infectious Diseases, Sivapalasingam et al. [1] describe an elegant epidemiologic investigation of a multistate outbreak of Salmonella enterica serotype Newport infection associated with mango consumption. The details of this investigation highlight a number of important issues demonstrating the substantial impact of recent changes in food processing and distribution on food safety, as well as the substantial contribution of modern tools to the traditional techniques of foodborne-disease epidemiologists.

Foodborne disease is reported to cause 76 million illnesses, 325,000 hospitalizations, and 5000 deaths in the United States each year [2]. A variety of factors contribute to the changing epidemiology of foodborne disease, including aging of the US population, the emergence of new pathogens, and changes in what Americans eat and where they eat it [3, 4]. The per capita consumption of fresh fruits and vegetables is increasing [3], as is the proportion of foodborne disease outbreaks associated with fresh produce [4]. The produce sections of our local supermarkets have come to resemble an international bazaar. At some times during the year, >75% of the produce we eat is harvested outside of the United States and delivered to our tables within days [4].

Mangoes are not a regular part of the typical American diet, and their increasing popularity is likely attributable to both an increase in the cultural diversity of the United States population and the “globalization” of our food supply, with increasingly widespread and regular access to new foods. This investigation adds to the list of recent foodborne disease outbreaks attributable to imported produce, including strawberries, melons, raspberries, parsley, and coconut milk, among others [5–9].

Because the origins of our foods have changed, so also have the epidemiologic characteristics of the foodborne diseases that result. Most foods were once produced and distributed locally. The traditional “church picnic” foodborne outbreak had a readily apparent explosive onset among a well-defined group of neighbors. Local health department personnel could manage the event with a little help from a standard microbiology laboratory.

In contrast, imported foodstuffs have a wide geographic distribution, and recent outbreaks have had subtle onsets, with relatively few cases that were geographically dispersed over several states and, as in the current instance, involving a product that previously might have gone unrecognized as a common source. The successful investigation of outbreaks provides a distinctive opportunity to identify new infectious agents, vehicles of transmission, modes of pathogen distribution, and other emerging risks, to identify prevention measures. To be successful, investigations hinge on the timely recognition of outbreaks to collect adequate specimens and conduct epidemiologic and environmental follow-up investigations. Large, diffuse outbreaks are beyond the resources of local public health departments and call for the collaboration of national and state public health authorities, as well as the application of innovative laboratory and epidemiologic resources.

Several new tools available to modern public health epidemiologists contributed to the recognition and successful elucidation of this outbreak. A computer-driven outbreak-recognition mechanism at the Centers for Disease Control and Prevention (CDC; Atlanta) detected an increase in reports of S. Newport infection nationally at the same time that a small
cluster of illness was recognized in just 1 state. The prompt availability of DNA fingerprinting results from various jurisdictions via PulseNet quickly confirmed that the scattered cases from several states were probably related. It is highly unlikely that, before the availability of such molecular techniques and communication networks, the 10 states with a half-dozen or fewer cases would have recognized this as a multistate outbreak. Similarly, the inclusion of cases from many states improved the power of the investigation and increased the likelihood of successfully identifying the vehicle and ultimately the mechanism of contamination leading to the outbreak. Finally, the ability to efficiently query a similar foodborne disease surveillance network in Europe quickly confirmed that the outbreak did not extend there, and, ultimately, a food processing step unique to United States–destined produce was implicated as the explanation.

Potentially easily overlooked in the description of this investigation is a reference to the Population Survey Atlas of Exposures developed by the CDC’s FoodNet program [10]. This unique resource has yet to be used to its full capacity, and this outbreak demonstrates its potential usefulness. The Atlas of Exposures provides population-based estimates of the patterns of consumption of a wide variety of foods, on the basis of telephone interviews of randomly selected households in various areas of the United States. With the results of a broad-based hypothesis-generating questionnaire in hand, the Atlas of Exposures can provide an indication of the responses that might be expected in a randomly selected population for comparison. In this event, for example, it might rapidly have become apparent that the proportion of patients who reported eating mangos (65%) was substantially higher than the proportion of the general population (5.3%) and of Asian and Hispanic populations (~30%) who reported mango consumption in the month before participation in the CDC’s population-based survey [10].

Tied closely to the issue of globalization of the food supply is the oft-referenced “law of unintended consequences.” In the current circumstance, the well-intentioned attempt to avoid a carcinogenic process while effectively controlling a potentially devastating crop pest led to the institution of a disinfestation process which inadvertently set the stage for the outbreak. Fortunately, another method for disinfestation of fruits and vegetables exists, and this outbreak provides yet another demonstration of the importance of advocating the widespread adoption of food irradiation, wherever appropriate [11].

Finally, this investigation provides a graphic demonstration of an underappreciated point—the potential for internalization of pathogens in fresh produce. As noted by Sivapalasingam et al. [1], the capacity of bacterial pathogens to work their way into the interior of plants has been demonstrated in a variety of fresh produce. No measure of peeling, scrubbing, or soaking in heavily marketed produce disinfectants will eliminate internalized pathogens. We appear to be left with the unsavory option of avoiding fresh fruits and vegetables and their attendant inarguable health benefits … or continuing to develop methods for improving food safety, including food irradiation.

We have heard much of the erosion of the public health infrastructure. In contrast, as Sivapalasingam et al. [1] have so satisfyingly demonstrated, the international tracing of foodborne disease is an area in which public health investigative techniques have kept pace with rapid change. In an era when food can find its way from a field in a developing country to a dinner table in Middle America in literally a matter of hours, the effective combined use of both tried-and-true and new epidemiologic techniques will be increasingly vital.

References