A Research Note

A Foodborne Outbreak Traced to Niacin Overenrichment

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ABSTRACT

In September 1983, the Vermont Department of Health identified seven employees who developed facial and skin flushing and erythema within minutes of eating lunch in a hospital cafeteria. None had vomiting or diarrhea. Because of the unusual nature of the symptoms, a case-control study was undertaken. All symptomatic individuals were interviewed regarding symptoms and food consumption. A case was defined as anyone who experienced visible erythema after lunch at the hospital on September 16. For each case, two friends who had eaten lunch in the cafeteria on the same day were selected as controls. All ill persons had consumed beef-rice soup, which was significantly associated with illness ($P<0.001$). The median time from consumption of soup to onset of symptoms was 10 min. The nature of symptoms and the brief incubation period suggested a toxic reaction to niacin. The niacin content per serving of soup consumed was determined to be 162 mg (12 times the total daily recommended amount of 13 mg). The excess niacin was traced to inadequate mixing of rice with enrichment powder at the processing plant. The investigation underscores the potential for toxic effects from foods which are improperly enriched.

RESULTS

Seven affected employees were identified; five were women and two were men. Their ages ranged from 23 to 60 years. All described an unpleasant sensation of burning or heat which was most intense in the face but was also present on the neck and arms. This was accompanied by intense redness in the face which looked like a severe sunburn or marked flush. The distribution of the erythema was predominantly facial and upper body (Fig.
The median time from consumption of beef-rice soup to onset of symptoms was 10 min (Fig. 2). Five ill persons had consumed a full 10-oz (283 g) bowl of soup and two had eaten 6 oz (170 g). The only other foods eaten by the ill persons before onset of symptoms were crackers; three had oyster crackers and two had saltines. Controls had eaten a variety of sandwiches and hot foods for lunch.

The hospital dietician reported that a volume equivalent to ten 10-oz (283 g) portions of soup had been served to employees. No patients were served the soup. If all the soup served had been consumed in ten portions, the approximate attack rate among soup eaters was seven in 70%. The suspect soup was pulled from the serving line and no further illness occurred.

The cook reported making 2 to 3 gal (7.6 to 11.4 L) of soup that morning from beef stock, rice, vegetables and garlic powder. He had forgotten to add the beef itself. The beef stock contained monosodium glutamate (MSG). The rice used to make the soup was medium grain, enriched rice; it was heavily coated with an off-white, fine coating of the rice with enrichment powder. The plant determined that the enrichment powder had been inadequately mixed with the rice before bagging so that there was opportunity for uneven distribution of enrichment among bags of the same lot. The enrichment powder had been added to the rice just before bagging, rather than at a point which would have allowed for even coating of the rice with enrichment powder. The plant had developed acceptable enrichment procedures under new management before the FDA investigation. All unused rice was recalled in Vermont and South Carolina and no further illness was identified.

**DISCUSSION**

In summary, there was a strong association in this outbreak between beef-rice soup ingestion and this flushing syndrome. The nature of the symptoms, the paucity of gastrointestinal symptoms, and the brief incubation period suggested a toxic agent in the soup as the cause of the outbreak. Niacin is a known cause of symptoms of this type and was present in more than a hundredfold excess in the rice used to make the soup, resulting in consumption of 8 to 12 times the total RDA of niacin by each of the ill persons in a single bowl of soup. Other causes of flushing (alcohol, menopause or vasoactive drugs) were considered but dismissed early in the outbreak. Although the beef stock contained MSG, the symptoms were not consistent with MSG toxicity.

Niacin or nicotinic acid, vitamin B3, is a precursor of nicotinamide adenine dinucleotide (NAD), a coenzyme involved in oxidation-reduction reactions in the body. Deficiency of NAD causes pellagra. Vasodilation of the skin and sensations of heat and itching are well-described and regular effects of oral administration of large doses of niacin (5,7). Gastrointestinal symptoms have also been described in some patients (7). Hepatocellular toxicity has...
been associated with chronic administration of three or more grams of niacin per day \((8)\).

Niacin has been reported as the cause of this flushing syndrome in several foodborne outbreaks. One was due to overenrichment of cornmeal \((3)\); another due to overenrichment of pumpernickel bagels \((4)\). Excess vitamin enrichment in food products appears to be a common mechanism for foodborne niacin outbreaks. The present outbreak is different from those previously reported in that the incubation period was shorter. This may have been due to rapid absorption of niacin by its consumption in hot soup.

In order to help prevent future outbreaks, consideration should be given to monitoring for excess enrichment at the processing plant rather than monitoring only for the absence of enrichment. Public health officials should recognize that, although this syndrome appears benign in healthy adults, it can be a marker for overenrichment of a food product and may lead to the discovery of deficiencies in the food production process.

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**REFERENCES**