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This presentation will deal with mycotoxins and other toxins and their links to diseases in children.



#### <<READ SLIDE>>

Most medical students learn very little about mycotoxins during their training. This is in contrast to veterinary medical students, who often learn quite a lot about mycotoxins because mycotoxins are well known to affect the health and development of horses, cows and other animals who eat moldy grains. Nonetheless, their effects on humans are increasingly being recognized.





Here is the story of this school outbreak: On March 23, 1998, a health department in the USA received a report that students in an elementary school became ill after eating lunch. Health officials obtained food and illness histories from 452 (77%) of the 584 students. A case was defined as nausea, abdominal cramps, vomiting, or diarrhea within 24 hours in a person after eating the school lunch on March 23. Of the 452 students, 155 (34%) had illnesses meeting the case definition.

Symptoms most commonly reported were nausea, headache, abdominal cramps, vomiting, and diarrhea. The median incubation period was approximately 15 minutes (range: 5-25 minutes), and median duration of illness was 4.5 hours (range: 10 minutes-8 hours).

From October 1997 through October 1998, 16 outbreaks of gastrointestinal illness associated with eating burritos occurred in the USA (in Florida, Georgia, Illinois, Indiana, Kansas, North Dakota, and Pennsylvania). All but one outbreak occurred in schools, and most of the approximately 1700 persons affected were children.

Ref:

•Centers for Disease Control and Prevention. Outbreaks of gastrointestinal illness of unknown etiology associated with eating burritos. In: *Morbidity and Mortality Weekly Report.* U.S. CDC, 1999, 48(10):210-3.

Image: WHO



During October 1997-March 1998, burritos from three outbreaks of gastrointestinal illness were traced to company A, and during May-October 1998, burritos from another 13 outbreaks were traced to company B. Three outbreaks were linked to chicken and bean burritos, pork-sausage and egg burritos, and beef burritos; the other 13 were linked to beef and pinto bean burritos. All burritos used tortillas made with wheat flour. The burritos were distributed frozen and prepackaged except in Florida, where the filling was prepared locally.

The major symptoms were nausea, headache, abdominal cramps, and vomiting, typically beginning within 60 minutes after eating a burrito and lasting less than 24 hours. No one was hospitalized.

Ref:

•Centers for Disease Control and Prevention. Outbreaks of gastrointestinal illness of unknown etiology associated with eating burritos. *In: Morbidity and Mortality Weekly Report.* U.S. Centers for Disease Control and Prevention, 1999, 48(10):210-3.



In a case-control study at one school, eight (57%) of 14 case-patients and five (13%) of 38 well children ate burritos (odds ratio {OR}=8.8; 95% Confidence Interval=1.8-47.6). In the other school, 11 (85%) of 13 case-patients and 11 (33%) of 33 well children ate burritos (OR=11.0; 95% Confidence Interval=1.8-87.6). The tortillas used to make the burritos were supplied by company B; the fillings, beef at one school and beef and pinto beans at the other, were made in the two school kitchens.

#### Ref:

•Centers for Disease Control and Prevention. Outbreaks of gastrointestinal illness of unknown etiology associated with eating burritos. In: *Morbidity and Mortality Weekly Report.* U.S. Centers for Disease Control and Prevention, 1999, 48(10):210-3.



For the differential diagnosis of foodborne illness with such a short incubation period, each of the following should be considered:

1. Staphylococcus aureus (which makes preformed toxins)

2. Bacillus cereus (emetic toxin)

3. Heavy metals (copper, tin, cadmium, iron, zinc)

4. Natural toxins (such as vomitoxin)

The short incubation periods suggest that a preformed toxin or other short-acting agent was the cause of illness. Possible agents include bacterial toxins (e.g. *Staphylococcus aureus* enterotoxin and *Bacillus cereus* emetic toxin); mycotoxins (e.g. deoxynivalenol (DON), acetyl-deoxynivalenol, and other tricothecenes), trace metals, nometal ions (e.g. fluorine, bromine, and iodine), plant toxins (e.g. alkaloids such as solarines, opiates, ipecac, and ergot; lectins such as phytohemagglutinin; and glycosides), pesticides (e.g. pyrethrins, organophosphates, and chlorinated hydrocarbons), food additives (e.g. biogenic amines, putrefaction, and free fatty acids), or an unknown toxin. Mass sociogenic illness is an unlikely explanation based on the number of different sites where outbreaks have been reported over a short interval and the link to only two companies.

Bacillus cereus emetic toxin and Staphylococcus aureus enterotoxin are common causes of food poisoning, but headache is not usually a prominent feature, and most outbreaks traced to these toxins have incubation periods of 2-4 hours, which is longer than observed in these outbreaks. Food samples from five outbreaks were negative for *B. cereus* and *S. aureus* by culture and toxin analysis; testing from these same outbreaks for alkaloids, biogenic amines, and pesticides also did not identify the causative agent.

Some metals, such as cadmium, copper, tin, and zinc, can irritate mucosal membranes and cause gastrointestinal illness after short incubation periods; however, only elemental aluminum was mildly elevated in the burrito samples, and there is no evidence that it causes these symptoms. Several plant toxins, such as phytohemagglutinin, may survive cooking and cause gastrointestinal symptoms; however, outbreaks associated with phytohemagglutinin have been linked to red kidney beans and not pinto beans.

Outbreaks with symptoms and incubation periods similar to those described in this report have occurred in China and India, where illness has been linked to consumption of products made with grains contaminated with fungi. These fungi produce heat-stable tricothecene mycotoxins called vomitoxin. In China, 35 outbreaks affecting 7818 persons during 1961-1985 were attributed to consumption of foods made with mouldy grain. Corn and wheat samples collected during two outbreaks had higher levels of DON than those collected at other times. In India in 1987, 97 persons consumed wheat products following heavy rains. DON and other tricothecene mycotoxins were detected in the implicated wheat products, and extracted toxins caused vomiting in laboratory tests on puppies. High doses of DON are known to cause vomiting in pigs.

Refs:

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