Journal of Bioterrorism & Biodefense

St Louis BW, J Bioterror Biodef 2015, 6:2
DOI: 10.4127/2157-2526.1000133

Review Article Open Access

Food Bioterrorism

Betty Wedman- St Louis*

Licensed Nutritionist and Environmental Health Specialist, USA

***Corresponding author:** Betty Wedman-St Louis, Licensed Nutritionist and Environmental Health Specialist, Metabolic Medical Center, 1120 S Belcher Rd, Ste 2, Largo, FL 33771, Tel: 727-826-0838; Fax: 727-826-0921; E-mail: dr.betty@betty-wedman-stlouis.com

Received date: January 29, 2015, **Accepted date:** February 28, 2015, **Published date:** March 7, 2015

Abstract

Ever since September 11, 2001 American society has had increased awareness of national security and the possible threat of another terrorist attack on U.S. soil. The American public continues to be reassured they have the safest food supply in the world, while a 2007 food science committee report of the US Food and Drug Administration criticized the ability of the FDA to oversee food safety issues and protect American consumers (Food Science Board, 2007). The Board indicated that as new technologies and chemicals are continually introduced into the US market, the FDA is unable to keep up with the scientific research to evaluate these technologies. Food products and chemicals are routinely allowed on the market and only removed if problems are identified.

Keywords: Bioterrorism; FDA; Contamination

Introduction

Ever since September 11, 2001, American society has had increased awareness of national security and the possible threat of another terrorist attack on U.S. soil. The American public continues to be reassured they have the safest food supply in the world, while a 2007 food science committee report of the US Food and Drug Administration criticized the ability of the FDA to oversee food safety issues and protect American consumers [1].

The Board indicated that as new technologies and chemicals are continually introduced into the US market, the FDA is unable to keep up with the scientific research to evaluate these technologies. Food products and chemicals are routinely allowed on the market and only removed if problems are identified.

The FDA subcommittee on Science and Technology exposed the crisis management in the two FDA food safety centers: CFSAN (Center for Food Safety and Applied Nutrition) and CVM (Center for Veterinary Medicine) since they have drawn attention and resources away from FDA's ability to develop the science-based infrastructure needed to efficiently provide routine surveillance and emergency investigations to protect the American consumer (Subcommittee on Science, 2007).

An assignment for Masters of Science - Nutrition students at New York Chiropractic College in Food Science class focused on the security of our food surveillance system. Each student was to develop a terrorist scheme that would affect the US food supply. The biochemical agent could be food or water based and needed to be sufficient to produce a realistic threat that would compromise the nation's confidence in our food supply.

Ten out of the twenty students provided outstanding food and water terrorism schemes that illustrated how easy biological weapons could cause massive injuries, economic disruption and erode confidence in the food supply (Table 1).

As the chart illustrates, symptoms of potential agents can be so similar with poor detention markers that early identification and treatment would be compromised.

Potential Plots on US Food and Water Supply

Anthrax

Two independent plot ideas were presented for anthrax as the biochemical agent to produce a threat to the nation's confidence in the food supply. Anthrax can be contracted by humans in three ways-cutaneously, gastrointestinally, and through inhalation of the spores.

One scheme used spore contamination of livestock and their feed. Since it is difficult to kill the spores on animal hides and in the feeding trough, workers not vaccinated would be subject to infection.

The technique for contaminating the feed lots would be for terrorists to spread spores over grazing or holding areas at night either through the irrigation system or added to bags of feed.

The other plot involved the white powder of anthrax being added to wheat flour, the staff of life in American diets. The terrorist group code named "Twinkie timebomb" could insure everything from plain crackers to pasta salads were contaminated. A Canadian based terrorist group crosses into the largely unguarded US border and adds anthrax powder to the flour mills of General Mills, Pillsbury, Kellogg's, etc. Few people would even consider their breakfast pancakes or cereal as the source of their illness. How long would it take for General Mills to do a total recall of Lucky Charms or Kellogg's to suspend production of their all natural Kashi line?

Economic losses from anthrax in the food supply could be staggering. Thousands of people would die and hundreds of thousands injured. FDA and other government agencies need better regulation of agriculture, livestock and food processing than currently exists if an anthrax terrorism threat is to be avoided.

Ricin

Ricin is a protein toxin found in the pulp of castor bean plants [2]. Once ricin enters the cells of the body it inhibits cells from making proteins they need to survive. As cells begin to die, the organs begin shutting down and the body dies [3]. Ricin can be ingested, inhaled or injected as a toxin with different symptoms resulting from the route of exposure [4]. The most deadly form of ricin is the purified powdered form- an amount the size of a pinhead can kill an adult [5].

Biological Agent	Symptoms	Contamination
Anthrax	Vomit, diarrhea, nausea, Flu-like symptoms	Grains, cereals, flour
Ricin	Vomit, diarrhea, nausea, Dehydration, seizures Hypotension	Foods sprayed on buffet, Beer brewery
Shigella	Vomit, diarrhea, cramping Fever, mucus stool	Produce section of supermarket
Clostridium Cryptosporidium	Vomit, hyper secretions, Nervous system shut down, Vomit, nausea, Abdominal Pain, Fever	Fast food restaurant, Botulinum, Spray onto produce super market
Saxitoxin	Lung paralysis, Death by asphyxia	Toxin sprayed as aerosol in planes
Compound 180 (Sodium Monofluroacetate)	Hypotention, Seizures, Dysrythmias, Respiratory stress	Prepared foods, Water supply, Fruit Juices

Table 1: Food and Water Bioterrorism Agents

Most symptoms associated with ingestion of ricin make a person believe they have food poisoning or a flu so treatment would be delayed and death soon follows.

A novel idea of using ricin as a terrorist plot involves two possible ways of contamination in a beer brewery. Purified ricin would be sprayed over the hops before they proceed through the processing plant. Because ricin is temperature sensitive, a terrorist group may elect to spray purified ricin onto the bottle caps thereby avoiding the possibility of high temperatures inactivating it during the brewing process. Since most people drink more than one beer at a time, the symptoms from ricin toxicity could be attributed to drinking too much instead of seeking medical care.

Ricin could also be used in buffet foods- salad bars, Chinese hot buffets, cafeteria grab-and-go kiosks. Severity of the symptoms would vary based on the dose which stalls detection of the ricin poisoning. No diagnostic test is available in emergency rooms and staff are poorly trained in recognizing natural toxins like ricin so food contamination would further be delayed.

Toxins like ricin are easy to make and castor beans are widely accessible, available, and affordable. Medical personnel need better training to identify and treat food-borne toxins to reduce fear and suffering.

Shigella

Shigella is a leading cause of dysentery that shows signs of infection one to seven days after exposure. It causes moderate morbidity and low mortality but needs diagnostics and surveillance by public health professionals.

Food-borne pathogens like shigella form a biofilm on fruits and vegetables which allows bacteria to adhere to the surface that cannot be washed off [6]. Once the biofilm from shigella forms, cooking is the only way it can be removed. Shigella causes an infection by invading the gastrointestinal cells and eliciting an intense inflammatory response which may not be fatal but would erode confidence in eating healthy fresh fruits and vegetables.

The produce department in supermarkets are a perfect target for shigella in a liquid state to be sprayed over salad greens, fresh herbs, melons, etc. Supermarkets in large urban areas could be targeted using a bicycle hydration pack strapped to the body with a dispensing cone taped to a finger for concealment.

Preparedness for identifying pathogens in the raw food sections of a supermarket is dismal. Food-borne pathogens like shigella may only cause death in the young and elderly but it leads to huge economic loss, fear in the population and overwhelmed medical facilities trying to manage a food terrorist attack. Better education of consumers, supermarket employee, and medical personnel is needed to reduce food-borne pathogen contaminations.

Clostridium Botulinum

Clostridium botulinum is considered one of the most poisonous substances in the world. According to the American Journal of Homeopathy Medicine if evenly dispersed and inhaled, a single gram of crystalline toxin could kill more than 1,000,000 people [7]. As a muscle paralyzing pathogen, it begins in the nervous system with the shut-down starting at the head and moving down through the body.

Symptoms of *clostridium botulinum* begin within 24 to 36 hours after ingestion which could make it an effective bioterrorist agent especially in a fast food restaurant. Many Americans are so engrossed in the fast food culture that they eat at least one meal a day in McDonalds, Taco Bell, Wendy's or Burger King.

An anti-toxin for *clostridium botulinum* is available once the source of the inflammation has been identified, but speed of identification is critical. The anti-toxin is effective in reducing symptom severity and many individuals may be able to recover after weeks to months of supportive care.

Cryptosporidium

Cryptosporidium is another pathogen that can survive and remain infectious in the environment for long periods. As a waterborne pathogen, it is highly contagious to humans and animals at low doses. The gastroenteritis caused from ingestion would be most severe for young children and immune compromised individuals [8].

The irrigation systems at local supermarkets are gold mines for a terrorist attack using cryptosporidium. Guidelines are not in place to insure that supermarkets check and assess the extensive underlying filtration system used for produce hydration. The water coming out of the spouts could be contaminated with cryptosporidium which creates film on the food and contaminates any customers in the area who inhale the mist.

Saxitoxin

Saxitoxin is a deadly toxin typically found in shellfish that have absorbed high concentrations of "red tide". This harmful algae bloom is responsible for isolated deaths and severe toxic poisoning when contaminated shellfish pass unnoticed into the food supply. Puffer fish are also a source of saxitoxin.

Synthesis of saxitoxin for a terrorist plot would require growing dinoflagellates in a remote or underground marine water source. Once adequate toxin is produced, it can be dispersed by aerosol into airplanes, trains or buses. Breathing the toxin causes paralysis in the lungs which leads to death by asphyxia.

As a tasteless, colorless toxin, saxitoxin was classified as a weapon in the 1950's and used in a capsule form as a suicide tablet for U2 pilots. A terrorism plot of spraying the toxin into mass transit is realistic and difficult to detect. Stafford and Hines indicate that urine testing is the only known means of evaluating the toxin in mammals at this time.

Sodium Monofluoroacetate

A potential terrorist agent with little consumer awareness is sodium monofluoroacetate or Compound 1080. It is a chemical commonly sold as a pesticide for rodents and coyotes [9]. Compound 11080 is colorless, odorless and lightly water-soluble so it can easily be used in the food supply. The CDC does not indicate any biological markers for sodium monofluoroacetate for diagnosis of exposure or poisoning (US Center for Disease Control and Prevention, 2005).

Repeated low dose exposures can be fatal [10] making this chemical very dangerous for terrorism schemes. Clinical effects develop 30 minutes to 2 hours after exposure, but can be delayed as long as 20 hours. No known antidote is available according to the CDC.

Compound 1080 is manufactured by a chemical company in Alabama despite its ban in the U.S. in 1972. Exports to other countries in a powdered form- like the one found in Iraq as part of Saddam Hussein's chemical terrorism lab- continue to make the news. In addition, exported banned products continue to be found in the American food supply.

Several methods by which Compound 1080 could be introduced as a terrorism agent include adding the powder to prepared foods in restaurants or catered events, stirring it into fruit juice or punch at a party, or introduced into the municipal drinking water supply.

A 2005 report by Congressional Research Service states:

"A fairly small number of large drinking water and wastewater utilities located primarily in urban areas (about 15% of the system) provide water services to more than 75% of the U.S. population. Arguably, these systems represent the greatest targets of opportunity for terrorist attacks..." [11].

Introduction of Compound 1080 could take place through fire hydrants, check valves or pump stations. Contaminated water could reach thousands of Americans undetected until well after symptoms set in. The lack of an effective antidote further enhances the damage economically and medically that this compound can cause.

Conclusion

A free society will always have exposures to terrorist activities but vigilance and surveillance are essential to minimize food terrorism events. These scenarios describe possible bioterrorism events pertinent in our society today that could be costly in economic, psychological and life-threatening ways. Some of these activities may already be recognized as potential targets by terrorists but inadequate measures have not been taken to foresee how to handle such plots and keep the food supply safe for all Americans.

References

1. FDA Science Board (2007). FDA science and mission at risk. Report of the Subcommittee on Science and Technology, USA.
2. Balint GA (1974) Ricin: the toxic protein of castor oil seeds. See comment in PubMed Commons below Toxicology 2: 77-102.
3. Day P, Pinheiro T, Roberts L, Lord J (2002) Binding of ricin A-chain to negatively charged phospholipid vesicles leads to protein structural changes and destabilizes the lipid bilayer. Biochemistry 41: 2836-2843.
4. Facts about ricin (2008) Centers for Disease Control and Prevention, USA.
5. Balint G (1974) Ricin: the toxic protein of castor oil seeds. Toxicology 2:77-102.
6. Heisig, E (2007) Rinsing veggies with water may not be enough. FoodHACCP.com newsletter, November 9 issue 279.
7. Merizalde B (2003) Botulism. Ame J Homeopathic Medicine 96: 94-99.
8. Nahrevanian H, Assmar M, Samin MG (2007) Cyrptosporidiosis among immune competent patients with gastroenteritis in Iraq with other enteropathic parasites. J Microbiol Immunol Inf 40: 154-156.
9. Proudfoot AT, Bradberry SM , Vale JA (2006) Sodium fluoracteate poisoning. Toxicol Rev 25: 213-19.
10. NorrisWR (2001) Sodium fluoracetate. International Programme on Chemical Safety, Malaysia.
11. Copeland C, Cody B (2005). Terrorism and security issues facing the water infrastructure sector. Congressional Research Service, RL32189, Library of Congress, USA.