

The causes and Effects of food borne Illness (Food Poisoning)

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ABSTRACT

Foodborne illness usually arises from improper handling, preparation, or food storage. Good hygiene practices before, during, and after food preparation can reduce the chances of contracting an illness. There is a consensus in the public health community that regular hand-washing is one of the most effective defenses against the spread of foodborne illness. Food poisoning, also called food borne illness, is illness caused by eating

contaminated food. Infectious organisms including bacteria, viruses and parasites or their toxins are the most common causes of food poisoning. It's not usually serious and most people get better within a few days without treatment. Statistically speaking, nearly everyone will come down with food poisoning at least once in their lives. The best way to prevent food poisoning is to handle your food safely and to avoid any food that may be unsafe.

Keywords: Food borne illness, food poisoning, causes, and effects.

INTRODUCTION

Food poisoning, also called food borne illness, is illness caused by eating contaminated food. Infectious organisms including bacteria, viruses and parasites or their toxins are the most common causes of food poisoning. It's not usually serious and most people get better within a few days without treatment. In most cases of food poisoning, the food is contaminated by bacteria, such as salmonella or Escherichia coli (E. coli), or a virus, such as the norovirus. Infectious organisms or their toxins can contaminate food at any point of processing or production [1] [2]. Contamination can also

occur at home if food is incorrectly handled or cooked. Food poisoning symptoms, which can start within hours of eating contaminated food, often include nausea, vomiting or diarrhea. Most often, food poisoning is mild and resolves without treatment. But some people need to go to the hospital. Although it's quite uncomfortable, food poisoning isn't unusual. According to the Centers for Disease Control and Prevention (CDC) Trusted Source, 1 in 6 Americans will contract some form of food poisoning every year.

METHODOLOGY

Incubation period

The delay between the consumption of contaminated food and the appearance of the first symptoms of illness is called the incubation period. This ranges from hours to days depending on the agent, and on how much was consumed. If symptoms occur within one to six hours after eating the food, it suggests that it is caused by a bacterial toxin or a chemical rather than life bacteria. The long incubation period of many foodborne illnesses tends to cause sufferers to attribute their symptoms to gastroenteritis. During the incubation period, microbes pass through

the stomach into the intestine, attach to the cells lining the intestinal walls, and begin to multiply there. Some types of microbes stay in the intestine, some produce a toxin that is absorbed into the bloodstream, and some can directly invade the deeper body tissues. The symptoms produced depend on the type of microbe [3]

Infectious dose

The infectious dose is the amount of agent that must be consumed to give rise to symptoms of foodborne illness, and varies according to the agent and the consumer's age and overall health.

Pathogens vary in minimum infectious dose; for example, *Shigella sonnei* has a low estimated minimum dose of < 500 colony-forming units (CFU) while *Staphylococcus aureus* has a relatively high estimate. [55] In the case of *Salmonella* a relatively large inoculum of 1 million to 1 billion organisms is necessary to produce symptoms in healthy human volunteers, [4] as *Salmonellae* are very sensitive to acid. An unusually high stomach pH level (low acidity) greatly reduces the number of bacteria required to cause symptoms by a factor of between 10 and 100.

Causes of food poisoning

Foodborne illness usually arises from improper handling, preparation, or food storage. Good hygiene practices before, during, and after food preparation can reduce the chances of contracting an illness. There is a consensus in the public health community that regular hand-washing is one of the most effective defenses against the spread of foodborne illness. The action of monitoring food to ensure that it will not cause foodborne illness is known as food safety. Foodborne disease can also be caused by a large variety of toxins that affect the environment [5] Furthermore, foodborne illness can be caused by pesticides or medicines in food and natural toxic substances such as poisonous mushrooms or reef fish.

Most food poisoning can be traced to one of the following three major causes:

Bacteria

Bacteria are by far the most prevalent cause of food poisoning. When thinking of dangerous bacteria, names like *E. coli*, *Listeria*, and *Salmonella* come to mind for good reason. *Salmonella* is by far the biggest culprit of serious food poisoning cases in the United States.

In the past, bacterial infections were thought to be more prevalent because few places had the capability to test for norovirus and no active surveillance was being done for this particular agent. Toxins from bacterial infections are delayed because the bacteria need time to multiply [6]. As a result, symptoms associated with intoxication are usually

not seen until 12-72 hours or more after eating contaminated food. However, in some cases, such as *Staphylococcal* food poisoning, the onset of illness can be as soon as 30 minutes after ingesting contaminated food. According to the CDC Trusted Source, an estimated 1,000,000 cases of food poisoning, including nearly 20,000 hospitalizations, can be traced to *salmonella* infection annually. *Campylobacter* and *C. botulinum* (botulism) are two lesser-known and potentially lethal bacteria that can lurk in our food.

Most common bacterial foodborne pathogens are:

- *Campylobacter jejuni* which can lead to secondary Guillain-Barré syndrome and periodontitis
- *Clostridium perfringens*, the "cafeteria germ"
- *Salmonella* spp. - its *S. typhimurium* infection is caused by consumption of eggs or poultry that are not adequately cooked or by other interactive human-animal pathogens
- *Escherichia coli* O157:H7 enterohemorrhagic (EHEC) which can cause hemolytic-uremic syndrome

Other common bacterial foodborne pathogens are:

- *Bacillus cereus*
- *Escherichia coli*, other virulence properties, such as enteroinvasive (EIEC), enteropathogenic (EPEC), enterotoxigenic (ETEC), enteroaggregative (EAEC or EA_gEC)
- *Listeria monocytogenes*
- *Shigella* spp.
- *Staphylococcus aureus*
- *Staphylococcal enteritis*
- *Streptococcus*
- *Vibrio cholerae*, including O1 and non-O1
- *Vibrio parahaemolyticus*
- *Vibrio vulnificus*
- *Yersinia enterocolitica* and *Yersinia pseudotuberculosis*

Less common bacterial agents:

- *Brucella* spp.
- *Corynebacterium ulcerans*

- Coxiella burnetii or Q fever
- Plesiomonas shigelloides

Parasites

Food poisoning caused by parasites is not as common as food poisoning caused by bacteria, but parasites spread through food are still very dangerous. Toxoplasma is the parasite seen most often in cases of food poisoning [6] [7] [8]. It's typically found in cat litter boxes. Parasites can live in your digestive tract undetected for years. However, people with weakened immune systems and pregnant women risk serious side effects if parasites take up residence in their intestines. Most foodborne parasites are zoonoses.

Platyhelminthes:

- Diphylobothrium sp.
- Nanophyetus sp.
- Taenia saginata
- Taenia solium
- Fasciola hepatica

Nematode:

- Anisakis sp.
- Ascaris lumbricoides
- Eustrongylides sp.
- Trichinella spiralis
- Trichuris trichiura

Protozoa:

- Acanthamoeba and other free-living amoebae
- Cryptosporidium parvum
- Cyclospora cayentanensis
- Entamoeba histolytica
- Giardia lamblia
- Giardia lamblia
- Sarcocystis hominis
- Sarcocystis suihominis
- Toxoplasma gondii

Viruses

Viral infections make up perhaps one third of cases of food poisoning in developed countries. Food poisoning can also be caused by a virus. The norovirus, also known as the Norwalk virus, causes over 19 million cases Trusted Source of food poisoning each year [9]. In rare cases, it can be fatal. Sapovirus, rotavirus, and astrovirus bring on similar symptoms, but they're less common. Hepatitis A virus is a serious condition that can be transmitted through food. In developed countries, more than 50% of

cases are viral and noroviruses are the most common foodborne illness, causing 57% of outbreaks in 2004. Foodborne viral infection are usually of intermediate (1-3 days) incubation period, causing illnesses which are self-limited in otherwise healthy individuals; they are similar to the bacterial forms described above.

- Enterovirus
- Hepatitis A is distinguished from other viral causes by its prolonged (2-6 week) incubation period and its ability to spread beyond the stomach and intestines into the liver. It often results in jaundice, or yellowing of the skin, but rarely leads to chronic liver dysfunction. The virus has been found to cause infection due to the consumption of fresh-cut produce which has fecal contamination.[42][43]
- Hepatitis E
- Norovirus
- Rotavirus

Symptoms of Food Poisoning

Statistically speaking, nearly everyone will come down with food poisoning at least once in their lives. There are some populations that are more at risk than others. Anyone with a suppressed immune system or an auto-immune disease may have a greater risk of infection and a greater risk of complications resulting from food poisoning.

According to the [10], pregnant women are more at risk because their bodies are coping with changes to their metabolism and circulatory system during pregnancy. Elderly individuals also face a greater risk of contracting food poisoning because their immune systems may not respond quickly to infectious organisms. Children are also considered an at-risk population because their immune systems aren't as developed as those of adults. Young children are more easily affected by dehydration from vomiting and diarrhea. Four well-known, classic symptoms are typical of gastroenteritis:

- Diarrhea (loose stools)
- Nausea (feeling sick or queasy)
- Vomiting

- Abdominal pain ('stomach cramps')

These symptoms can occur in any combination; they generally have a sudden (acute) onset, but this, and symptom severity, can vary. The onset of symptoms after eating contaminated food can be within a few hours, but the incubation period can also be much longer, depending on the pathogen involved. Vomiting usually happens earlier on in the disease, diarrhea usually lasts for a few days, but can be longer depending on the organism that is causing the symptoms [11].

High risk groups and complication of Food Poisoning

Even if you become ill after eating contaminated food depends on the organism, the amount of exposure, your age and your health. The following are the High-risk groups:

Pregnant women: During pregnancy, changes in metabolism and circulation may increase the risk of food poisoning. Your reaction may be more severe during pregnancy. Rarely, your baby may get sick, too.

Infants and young children: Their immune systems haven't fully developed.

Older adults: As you get older, your immune system may not respond as quickly and as effectively to infectious organisms as when you were younger.

People with chronic disease: Having a chronic condition such as diabetes, liver disease or AIDS or receiving chemotherapy or radiation therapy for cancer reduces your immune response.

The most common serious complication of food poisoning is dehydration a severe loss of water and essential salts and minerals [12]. If you're a healthy adult and drink enough to replace fluids you lose from vomiting and diarrhea, dehydration shouldn't be a problem. Infants, older adults and people with suppressed immune systems or chronic illnesses may become severely dehydrated when they lose more fluids than they can replace. In that case, they may need to be hospitalized and receive intravenous fluids. In extreme cases, dehydration can be fatal [13].

Prevention of Food Poisoning

The best way to prevent food poisoning is to handle your food safely and to avoid any food that may be unsafe. Some foods are more likely to cause food poisoning because of the way they're produced and prepared [14]. Meat, poultry, eggs, and shellfish may harbor infectious agents that are killed during cooking. If these foods are eaten in their raw form, not cooked properly, or if hands and surfaces are not cleaned after contact, food poisoning can occur. To prevent food poisoning at home:

- Wash your hands, utensils and food surfaces often. Wash your hands well with warm, soapy water before and after handling or preparing food. Use hot, soapy water to wash utensils, cutting boards and other surfaces you use.
- Keep raw foods separate from ready-to-eat foods. When shopping, preparing food or storing food, keep raw meat, poultry, fish and shellfish away from other foods. This prevents cross-contamination.
- Cook foods to a safe temperature. The best way to tell if foods are cooked to a safe temperature is to use a food thermometer. You can kill harmful organisms in most foods by cooking them to the right temperature.
- Cook ground beef to 160 F (71.1 C); steaks, roasts and chops, such as lamb, pork and veal, to at least 145 F (62.8 C). Cook chicken and turkey to 165 F (73.9 C). Make sure fish and shellfish are cooked thoroughly.
- Refrigerate or freeze perishable foods promptly — within two hours of purchasing or preparing them. If the room temperature is above 90 F (32.2 C), refrigerate perishable foods within one hour.
- Defrost food safely. Don't thaw food at room temperature. The safest way to thaw food is to defrost it in the refrigerator. If you microwave frozen food using the "defrost" or "50 percent power"

setting, be sure to cook it immediately.

- vii. Throw it out when in doubt. If you aren't sure if a food has been prepared, served or stored safely, discard it. Food left at room temperature too long may contain bacteria or toxins that can't be destroyed by cooking. Don't taste food that you're unsure about — just throw it out. Even if it looks and smells fine, it may not be safe to eat.

Food poisoning is especially serious and potentially life-threatening for young children, pregnant women and their fetuses, older adults, and people with weakened immune systems. These individuals should take extra precautions by avoiding the following foods:

- i. Raw or rare meat and poultry
- ii. Raw or undercooked fish or shellfish, including oysters, clams, mussels and scallops
- iii. Raw or undercooked eggs or foods that may contain them, such as cookie dough and homemade ice cream
- iv. Raw sprouts, such as alfalfa, bean, clover and radish sprouts
- v. Unpasteurized juices and ciders
- vi. Unpasteurized milk and milk products
- vii. Soft cheeses, such as feta, Brie and Camembert; blue-veined cheese; and unpasteurized cheese
- viii. Refrigerated pates and meat spreads
- ix. Uncooked hot dogs, luncheon meats and deli meats

Treatment of Food Poisoning

Food poisoning can usually be treated at home without seeking medical advice. Most people will feel better within a few days [15] [16]. It's important to avoid dehydration by drinking plenty of water, even if you can only sip it, as you need to replace any fluids lost through vomiting and diarrhoea. You should do the following:

- Rest as much as possible
- Eat when you feel up to it sticking to small, light and non-fatty meals at first (bland foods such as toast,

crackers, rice and bananas are good choices)

- Avoid alcohol, caffeine, fizzy drinks and spicy and fatty foods because they may make you feel worse

Contact your GP if your symptoms are severe or don't start to improve in a few days. If you have food poisoning, you shouldn't prepare food for other people and you should try to keep contact with vulnerable people, such as the elderly or very young, to a minimum [17] [18]. If someone you live with has food poisoning, you should:

- Make sure everyone in your household (including yourself) washes their hands with soap and warm water regularly - particularly after going to the toilet and before and after preparing food
- Clean surfaces, toilet seats, flush handles, basins and taps frequently
- Make sure everyone has their own towels and flannels
- Wash the laundry of the infected person on the hottest washing machine setting

Oral rehydration solutions (ORS) are recommended for people vulnerable to the effects of dehydration, such as the elderly and those with a pre-existing health condition. ORSs are available in sachets from pharmacies [19]. You dissolve them in water to drink and they help replace salt, glucose and other important minerals your body loses through dehydration [20].

If your symptoms are severe or persistent, or you are more vulnerable to serious infection (for example, because you are elderly or have an underlying health condition), you may need further treatment [21]. Tests may be carried out on a stool sample to find out what is causing your symptoms and antibiotics may be prescribed if the results show you have a bacterial infection. Medication to stop you vomiting (anti-emetics) may also be prescribed if your vomiting is particularly severe. In some cases, you may need to be admitted to hospital for a few days so you can be monitored and

given fluids directly into a vein (intravenously) [22].

CONCLUSION

While having food poisoning is quite uncomfortable, the good news is that most people recover completely within 48 hours. Food poisoning can be life-threatening, however the CDC says this is extremely rare. It's advisable to hold off on solid foods until vomiting and diarrhea have passed and instead ease back to your regular diet by eating simple-to-digest foods that are bland and

low in fat, such as: saltine crackers, gelatin, bananas, rice, oatmeal etc. To prevent your stomach from getting more upset, try to avoid the following harder-to-digest foods, even if you think you feel better: dairy products, especially milk and cheeses, fatty foods, highly seasoned foods, food with high sugar content, spicy foods, fried foods, caffeine (soda, energy drinks, coffee), alcohol.

REFERENCES

1. Henry, Michael H. "Mycotoxins in Feeds: CVM's Perspective". FDA.gov. Retrieved January 1, 2012.
2. Webley DJ, Jackson KL, Mullins JD, Hocking AD, Pitt JI (1997). "Alternaria toxins in weather-damaged wheat and sorghum in the 1995-1996 Australian harvest". Australian Journal of Agricultural Research. 48 (8): 1249-56.
3. Li F, Yoshizawa T (2000). "Alternaria mycotoxins in weathered wheat from China". J. Agric. Food Chem. 48 (7): 2920-4.
4. Motta SD, Valente Soares LM (2001). "Survey of Brazilian tomato products for alternariol, alternariol monomethyl ether, tenuazonic acid and cyclopiazonic acid". Food Addit Contam. 18 (7): 630-4.
5. Li FQ, Toyazaki N, Yoshizawa T (2001). "Production of alternaria mycotoxins by Alternaria alternata isolated from weather-damaged wheat". J. Food Prot. 64 (4): 567-71.
6. Marasas WF (1995). "Fumonisin: their implications for human and animal health". Nat. Toxins. 3 (4): 193-8,
7. Soriano, J.M. (2004). "Occurrence of fumonisins in foods". Food Research International. 37 (10): 985-1000.
8. Sabater-Vilar M, Nijmeijer S, Fink-Gremmels J (2003). "Genotoxicity assessment of five tremorgenic mycotoxins (fumitremorgen B, paxilline, penitrem A, verrucologen, and verrucosidin) produced by molds isolated from fermented meats". J. Food Prot. 66 (11): 2123-9.
9. Adejumo TO, Hettwer U, Karlovsky P (May 2007). "Occurrence of Fusarium species and trichothecenes in Nigerian maize". Int. J. Food Microbiol. 116 (3): 350-7.
10. Mazur LJ, Kim J (2006). "Spectrum of noninfectious health effects from molds". Pediatrics. 118 (6): e1909-26.
11. Froquet R, Sibiril Y, Parent-Massin D (2001). "Trichothecene toxicity on human megakaryocyte progenitors (CFU-MK)". Hum Exp Toxicol. 20 (2): 84-9.
12. Joffe AZ, Yagen B (1977). "Comparative study of the yield of T-2 toxic produced by Fusarium poae, F. sporotrichioides and F. sporotrichioides var. tricinctum strains from different sources". Mycopathologia. 60 (2): 93-7.
13. Hay, R. J. (2007). "Fusarium infections of the skin". Current Opinion in Infectious Diseases. 20 (2): 115-117.
14. Hohn, Thomas M. "Trichothecene-resistant transgenic plants". U.S. Patent 6,646,184. Priority date March 31, 1999.
15. Dubois E, Hennechart C, Deboosère N, et al. (April 2006). "Intra-laboratory validation of a concentration method adapted for the enumeration of infectious F-specific RNA coliphage, enterovirus, and hepatitis A virus from inoculated leaves of salad

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- vegetables". *Int. J. Food Microbiol.* 108 (2): 164-71.
16. Schmidt, Heather Martin. "Improving the microbiological quality and safety of fresh-cut tomatoes by low dose electron beam irradiation - Master thesis" (PDF). Retrieved August 11, 2007.
 17. Lucie Wartique, Lucie Pothen, Nathalie Pirson, Michel P. Hermans, Michel Lambert & Halil Yildiz (2017) An unusual cause of epidemic thyrotoxicosis, *Acta Clinica Belgica*, 72:6, 451-453,
 18. Hedberg CW, et al. An outbreak of thyrotoxicosis caused by the consumption of bovine thyroid in ground beef. *N Engl J Med* 1987;316:993-8.
 19. Malvinder S. Parmar and Cecil Sturge Recurrent hamburger thyrotoxicosis. *CMAJ.* 2003 Sep 2; 169(5): 415-417.
 20. Greig, Judy D. "Infective Doses and Pathogen Carriage". Public Health Agency of Canada.
 21. Owens, Michael D (January 2014) Salmonella Infection in Emergency Medicine. *emedicine.com*
 22. Scallan E, Griffin PM, Angulo FJ, Tauxe RV, Hoekstra RM (2011). "Foodborne illness acquired in the United States—unspecified agents". *Emerging Infectious Diseases.* 17 (1): 16-22.