



## Food Poisoning: causes, precautions, diagnosis and treatment: A brief review

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## ABSTRACT

Food poisoning is the pathological condition when a person gets sick after consuming a particular foodstuff which is mostly contaminated with either pathogenic bacteria or any other pathogen or virus. In food poisoning, person suffers from vomiting, abdominal cramps and diarrhea. Sometimes, under severe conditions, there may be fever and blood in feces etc. Body dehydration is also common due to loss of liquid from the body during diarrhea. If precautions are taken, food poisoning is not much life threatening. However, on prolonged and severe food poisoning, many times, persons also die. Here, in the present mini-review, a brief discussion on causes, diagnosis, symptoms and treatment about food poisoning has been done.

**Keywords:** Pathogenic bacteria, *Escherichia coli*, *Salmonella typhimurium*, *Vibrio vulnificus*, allergens

**INTRODUCTION:** When a person gets sick after consuming a foodstuff, it is normally called as 'Food poisoning'. The most basic symptoms of food poisoning are vomiting, pain in stomach, diarrhea etc. It is considered that food poisoning is as a result of consuming toxic or contaminated food. As per available information; cases of food poisoning are more common in poor and developing countries; however, people from developed countries also suffer from food poisoning. To bring awareness about food poisoning, its causes and precautions to be taken, the present mini-review was planned. A brief discussion about food poisoning, its symptoms, and agents causing food poisoning, diagnosis and treatment has been carried out.

**Symptoms:** There is no definite time limit when symptoms of food poisoning are felt by the patient after consuming a toxic or contaminated food. It depends on the type of toxic or contaminated material present in the food and its quantity. It also depends on the body defense mechanism of the person. Symptoms may be visible within an hour of consuming contaminated food or sometimes even after many days or weeks. The common symptoms of food poisoning are abdominal pain (cramps), nausea, vomiting, diarrhea, fever, headache etc. The symptoms must not be ignored if persist for a longer time. It has been reported that sometimes, food poisoning may be life threatening. In fact, many deaths occur annually due to food poisoning. As per recent data released by the World Health Organization (WHO), on an average, one in ten people falls sick due to food poisoning every year and there are nearly 420,000 deaths due to food poisoning every year. Out of these, more than 50% deaths are due to diarrhea. If any person suffers any of the following symptoms, it is recommended that person must consult the doctor as soon as possible:

- Dehydration in the body which may be indicative by dry mouth, problem in drinking liquids, no or little excretion of urine.
- Having problem in speaking or eye sight.
- High fever (more than 102°F).

- Severe diarrhea persisting more than a couple of days
- Visibility of blood in the urine.

**Agents causing food poisoning:** There may be two different types of contaminants in the food responsible for causing food poisoning. These are living and non-living agents. The living agents include bacteria, other pathogens and viruses, and the non-living agents may be certain toxins secreted by the bacteria or other pathogens, certain poisonous chemicals which sometimes are added as preservatives or certain physical agents.

**Bacteria:** Although, a large number of pathogenic bacteria are known, all do not contaminate foodstuff. There are only few pathogenic bacteria which contaminate the food and may cause food poisoning (Mayounga, 2018). There are many steps through which food has to pass starting from leaving the farm area and up to ready to eat food reaching on the dining table. All these steps together are called as 'food production chain'. In spite of taking care, probability always exists for the pathogenic microbes to contaminate the food (Lynch *et al.*, 2009; Kumar, 2019). The level of contamination and nature of the microbe also depends upon its animal or plant origin. The most common pathogenic bacteria which contaminate food are *Escherichia coli*, *Salmonella typhimurium* and *Vibrio vulnificus*. All these three bacteria are reported to be transferred in the body of humans through contaminated food and food is contaminated by water (Kumar, 2019). *Escherichia coli* and *Salmonella typhimurium* have also been reported to be present in manures and survive for a longer time. There are also reports that *E. coli* strain becomes resistant to acids and thereafter, survives in the stomach of humans and colon of many other animals especially which survive on grain feed (Okafu *et al.*, 2003). A particular pathogenic strain of *Escherichia coli* named as strain O157:H7 has been reported in lettuce where it reaches through irrigating water (Fonseca *et al.*, 2011). This strain has also been found in other vegetables and fruits. Not only plant products, this strain of *E. coli* has also been reported in various animal origin foods like pork, chicken, beef, milk and milk products. This strain of *E. coli* may contaminate water if fecal matter is in the surrounding.

This is deadly harmful bacteria which may cause diarrhea, abdominal cramps, vomiting, colitis or even kidney failure (Alum *et al.*, 2016).

In addition, *Campylobacter* sp. is also much lethal bacteria which contaminates food and causes food poisoning. There are reports that wild animals in surroundings of farms are the carriers of *Campylobacter* sp. These lethal bacteria may cause diarrhea, fever, vomiting and abdominal cramps etc. Food may also get contaminated with pathogenic bacteria during harvesting. The equipments, instruments and vehicles such as choppers, knives, boxes, trailers, truck beds etc. are the sources of pathogenic bacteria (Kumar, 2019). In case of animal derived food, unhygienic atmosphere at or near the slaughter house, poultry, feedlots during transport, lairage before and after slaughter may also add bacterial contamination in food (Miller and Griffin, 2012). If poultry animals are fed bacterial contaminated foodstuffs, poultry chicken and eggs may get contaminated with food poisoning bacteria. In poultry animals, drinking water, rodents, dogs, cats, birds, faeces and clothes via surrounding environment may infect poultry animals and their derived food. Packaging material used for packaging the food, if contaminated, will contaminate the food. Many other pathogenic bacteria such as *Clostridium perfringens*, *Staphylococcus aureus*, *Clostridium* sp., *Listeria monocytogenes*, *Bacillus cereus*, *Toxoplasma gondii*, *Shigella* sp., *Entamoeba histolytica* and *Cyclospora* sp. have been reported to contaminate foodstuffs throughout the food production chain (Kumar, 2019). Bintsis (2018) in a review discussed the status of microbial pollution in foodstuffs. Zeighami *et al.* (2020) reported that *Bacillus cereus* is an important cause of food poisoning globally. They collected 200 different samples of meat from different retailer shops and restaurants in Zanjan, Iran and studied the presence of hemolysin BL and non-hemolytic enterotoxin genes. They found that 14.1 % raw meat samples and 15% cooked meat samples showed presence of *Bacillus cereus*. They also showed that 89.6% isolates had one or more enterotoxin genes. Hemolysin BL genes were comparatively in lower frequency than non-hemolytic enterotoxin genes. Presence of enterotoxigenic *Bacillus cereus* in meat samples is a probable risk for public health. They also recommended that routine testing of foods must be carried out for the presence of enterotoxigenic *Bacillus cereus*. As per estimate, alone in USA, on an average, annually nearly 1,00,000 cases of food poisoning with 20,000 admissions in various hospitals are reported and in most cases, *Salmonella* infection is found.

**Parasites:** Although food poisoning due to parasites is not much frequent unlike bacterial infection, still a few dangerous parasites have been reported. *Toxoplasma* has been reported responsible for food poisoning. It has been reported in cat litter boxes. It is also found that certain parasites may stay in the digestive tract for years and these may be dangerous for pregnant ladies and sick persons who got weakened immune system. It has been found that other food borne parasites are tapeworms, roundworms and protozoa which may cause various diseases. Chang *et al.* (2019) reported the presence of anisakid larvae in anchovies (*Engraulis japonica*) fish found in Korea. On the basis of their studies and results obtained, they

suggested that anchovies could be a potential source of human anisakiasis in Korea.

**Viruses-** A number of viruses have been reported which enter in the body through food and cause various dreaded diseases. The norovirus has been shown to be responsible for food poisoning in majority of cases. Many other viruses such as rotavirus and astrovirus are also reported to enter in the body through food. Hepatitis viruses have also been reported to enter in the body via food (Kumar, 2019).

**Toxins and contaminants-** In some cases, food poisoning occurs due to the presence of some toxins in the food. These toxins may be natural toxins or added. Many times, food preservatives are added which if consumed in more quantity, act as toxic materials. The polluting substances present in the environment enter in the human body through ingestion, absorption, inhalation and injection etc and cause adverse reactions. These food borne diseases may also cause disability and another diseases. These diseases may be caused due to toxins produced by bacteria or other toxic substances present in the food. The diseases may be like diarrhea, toxic shock syndrome, debilitating infections such as meningitis and even death. Pathogenic bacteria present in food may have multiple factors of virulence responsible for infection. Some bacterial species may produce toxins directly in the food whereas some others may produce them after they get colonized in the intestine. They mentioned that main pathogenic bacteria are *Salmonella* sp., *Vibrio parahaemolyticus*, *Vibrio cholerae*, *Staphylococcus aureus*, *Clostridium botulinum*, *Clostridium perfringens*, *Bacillus cereus*, *Listeria monocytogenes*.

**Allergens-** Quite often, it has been observed that a substance present around or is consumed even in much smaller quantity, triggers defense system in the body of a particular person, then that substance is called as allergen for that person and the phenomena as allergy. It is pertinent to mention that for other persons, it is a normal substance and body behaves normally. There are certain foodstuffs like nuts, fish, egg, milk and cereals which have been observed to be allergens for certain individuals. Most common symptom visible on the body as a result of allergy is rashes on the skin. In certain cases, there may be difficulty in normal breathing, severe abdominal cramps or even problem in cardiovascular system. Sometimes, these symptoms may be so fatal that risk of life occurs. Kassahun and Wongiel (2019) studied food poisoning cases in *Dewachfa worecha* of Ethiopia. They found that 35 food poisoning cases with no death were reported during 2018 and overall attack rate was 25.58 out of 10,000. Eating raw meat, drinking raw milk, sex, no hand washing before eating and sources of drinking water were significantly associated with food poisoning.

**Precautions to be taken to avoid food poisoning:** It is always preferred to consume food after cooking at or more than 70°C temperature. In general, most of the bacteria, parasite and viruses get killed on heating at higher temperature. It is also true that on heating at higher temperature, there is loss of many nutrients especially the heat labile vitamins. These heat labile vitamins may be taken as supplements in the diet. There are many foods especially fruits and some vegetables which are eaten in raw form (without heating). These foods are the

sources of microbial contamination leading to food poisoning. In these cases, it is always preferred to wash these foods thoroughly before eating to washout microbial contamination. Nowadays, it is also preferred to boil such vegetables or steam sterilized before eating. Many times, when person does not wash the hands thoroughly after using toilet and touch or eat the food using those hands, there is a probability of the food to get contaminated with the microbes present in the faecal matter. Therefore, it should be assured that person washes the hands after using toilet, before touching or cooking the food. Not only this, one should also wash the hands thoroughly before taking any meal. The milk and other dairy products, meat and eggs have been found to get contaminated much frequently. Therefore, it is necessary to heat or cook or sterilize these products before consumption. The most important is water which is drunken or used in preparation of many foods, get contaminated with pathogenic microbes. Many times, if water pipelines are very near to faecal matter or drainage lines, get contaminated with the microbes present in faecal matter or dirty water. [Zyoud et al. \(2019\)](#) interviewed four hundred and twelve parents and out of those 92.7% were mothers. The study was conducted in Nablus district of Palestine between May and July, 2015. In the study, data were collected on food safety knowledge, attitudes and practices along with socio-demographic characteristics. After doing analysis of the data they concluded that knowledge, attitude and practices regarding measures for avoiding food poisoning among their children are associated with each other and get influenced by the socio-economic variables. On the basis of data collected, they recommended the conduct of health education programs and general awareness programs in order to educate the parents to follow food safety measures strictly and to enhance their awareness level. If non-vegetarian diets are prepared, then in addition to coliforms, contamination of *Staphylococcus aureus* (MRSA) bacteria was also detected. Unhygienic conditions are responsible for such contaminations on towels which are strong source of these pathogenic bacteria in the food. Study showed that 37% of towels showed contamination of coliforms, 37% had Enterococcus bacteria whereas 14% developed *Staphylococcus aureus*. It has been recommended to use disposable, single use sterile paper towels in the kitchen. [Ding et al. \(2019\)](#) reported that food borne bacteria, *Bacillus cereus* is widely found in different environments and may also be present in fresh vegetables. Therefore, fresh vegetables especially which are consumed raw or processed minimally and are not sterilized by proper heat treatment, must be evaluated for the presence of *B. cereus*. They studied vegetables from different cities of China to analyze genetic polymorphism, presence of virulence genes and antimicrobial resistance. They found presence of *B. cereus* in nearly 50% samples of vegetables and out of those, nearly 10% had contamination level of more than 1100 MPN (most probable number)/g. They also detected the presence of virulence genes in more than 80% positive samples. Therefore, fresh vegetables must be thoroughly washed with clean water properly and it is preferable not to eat raw vegetables. [Finger et al. \(2019\)](#) assessed the food borne diseases (FBD) outbreaks reported between the year 2000 to 2018 in Brazil. According to official data of Brazilian Ministry of

Health, 13,163 FBD outbreaks occurred in Brazil during this period and 247, 570 cases were reported and out of these 195 deaths occurred. In many outbreaks, *Salmonella* infection was detected. These data indicated alarming situation of food poisoning in Brazil and there is need to take full precautions and to educate the people.

**Persons prone to food poisoning:** Almost every person is at risk for food poisoning. It is estimated that almost everyone suffers from food poisoning at least once in his or her life. Since animals including humans have defense systems to fight against the contaminations, those who suffer from auto-immune disease are more prone to food poisoning. It is also found that pregnant ladies are at more risk because their bodies cope up with changes in their metabolism and circulatory systems during pregnancy. Older people are also at more risk since their immune systems generally do not respond quickly to infectious microbes. Young children are also more prone to food poisoning since their immune system remains lesser developed compared to adults. Children also get dehydration more rapidly upon vomiting and diarrhea.

**Diagnosis for food poisoning:** Mostly doctors diagnose food poisoning on the basis of symptoms like abdominal cramps, vomiting and/or diarrhea. These symptoms mostly occur within few hours of consuming food. In some cases, symptoms may be visible after a day or two days of consuming contaminated food. Sometimes along with these symptoms, person may suffer from high fever, dehydration in the body, blood in faeces, dry throat and inability of engulfing any food or liquid down in the alimentary canal (there is immediate vomiting on keeping food or liquid in the buccal cavity and doing effort to swallow the same. Sometimes, doctors prefer to conduct certain pathological tests to confirm. There are large number of bacteria and other pathogens responsible for food poisoning. Stool culture is the most common pathological test where presence of pathogenic bacteria/ parasite is determined. Sometimes, DNA fingerprint of the pathogenic bacteria present in the stool is also carried out which help in prescribing the antibiotics.

**Treatments for food poisoning:** Most doctors prescribe antibiotics capable of killing the responsible bacteria or other pathogen. However, with awareness of ill-effects of antibiotics, nowadays, many people do not prefer to take antibiotics. In that case, doctors prescribe electrolytes to keep the body hydrated. There are many soft drinks which may also be taken for maintaining ionic balance in the body especially of sodium and potassium ions. Fruit juice and /or coconut water is also preferred to consume in order to regain body hydration. It is always advised not to consume any drink having caffeine since it irritates the digestive tract. In severe cases, it is preferred to give intravenous saline cum glucose for hydration purpose.

**CONCLUSION:** Food poisoning generally occurs mostly after consuming some contaminated foodstuff. The contamination may be of pathogenic bacteria, parasite or virus. Sometimes, allergen may also cause food poisoning. If proper care is taken and timely treatment is done, it is mostly curable. However, sometimes when it is severe and prolong for a longer time, it may be life threatening. People must take care of food safety before consuming it. It is also true that almost every person

globally becomes sufferer of food poisoning at least once in life time in spite of taking precautions. There may be more emphasis on food quality and food safety globally since food poisoning occurs in developed as well as developing and poor countries.

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