

A CLINICAL REVIEW OF FOOD POISONING

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Abstract: Food poisoning is a common problem that almost everyone experiences at least once in their life. The rate of infection is estimated at 76 million cases annually, about 325,000 cases are treated in hospitals to about 5,000 deaths. The aim of this review is to explore the etiology, the symptoms, laboratory tests that can be performed, treatments in cases of food poisoning, and how food poisoning can be prevented. The writing methodology used is a literature review. The literature source consists of relevant journals and books from the search engines PubMed and Google Scholar. There are 3 factors that cause food poisoning, first is the patient factor or immunity, environment factor and food factor or the etiology or bacteria that contaminate the food. Food poisoning can have various presentations, ranging from clinically mild illness that requires only outpatient care to severe illness that requires hospitalization. Mostly doctors diagnose food poisoning on the basis of symptoms like abdominal cramps, vomiting and/or diarrhea. Important initial management of food poisoning are adequate hydration. Anti diarrhea or anti vomiting drugs should be used cautiously. However, if patients are not responsive to rehydration, patients should be hospitalized to be re-hydrated. Empirical therapy with antibiotics may be considered in high risk patients. Prevention is always better than cure the disease. It is always preferred to consume food after cooking at or more than 70°C. It should be assured to washes the hands before touching or cooking the food, and before taking any meal.

Keywords: Food Poisoning, Etiology, Symptoms, Clinical Diagnosis, Treatment, Prevention.

I. INTRODUCTION

Poisoning is the harmful effect that occurs when a toxic substance is swallowed or inhaled or upon contact with the skin, eyes, or mucous membranes, such as those in the mouth or nose. Possible toxicants include over-the-counter and prescription drugs, prohibited drugs, gases, chemicals, vitamins, foods, mushrooms, plants, and animal poisons. Some toxins cause no harm, while others can cause severe damage or death.¹

Food poisoning is a common problem that almost everyone experiences at least once in their life. Food poisoning also called foodborne illness or foodborne disease is defined as a condition that usually results from eating food contaminated with infectious microorganisms (viral, bacterial, parasitic or fungal) or toxins secreted during the different stages of food processing, production or preservation. It has been reported that about 30% of the total population in the industrialized countries themselves suffer from food poisoning annually. The rate of infection with food-borne diseases is estimated at 76 million cases annually, of which about 325,000 cases are treated in hospitals, in addition to about 5,000 deaths.^{1,2}

Food poisoning is linked directly or indirectly with infectious agents, which are spread through the fecal-oral route, on contaminated hands, or in contaminated food and water, which results causing a serious problem in humans.³

The clinical features of foodborne infection are dependent on the pathogenic mechanisms involved. Headache, giddiness, colicky pain, cold and clammy skin, intense thirst, acute vomiting, diarrhea, slow pulse, rigors, and cramps are the symptoms seen in humans, which are caused by food poisoning.^{3,4} The condition of food poisoning is characterized by (a) the attack of many persons at the same time, (b) history of ingestion of common food, and (c) similarity of signs and symptoms in the majority of cases.⁵ The diagnosis is based on symptoms, information from the poisoned person and those present, and sometimes from urine and blood tests.¹

Although everyone can get food poisoning, some people are more susceptible to get food poisoning than others, including infants and children, pregnant women and their fetuses, older adults and people with chronic diseases. People in these groups are also more likely to have severe clinical pictures or complications of food poisoning. Food safety is especially important for people in these groups, who are more likely to get food poisoning and have complications.^{6, 7, 8} Infants and children are 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.^{9, 10} Hazards causing human food poisoning may lead to dangerous health problems such as health problems during pregnancy and pregnancy complications. Pregnant women are more at risk because their bodies are coping with changes to their metabolism and circulatory system during pregnancy. During pregnancy, changes in metabolism and circulation may increase the risk of food poisoning. The symptoms may be more severe during pregnancy and affect the fetus. Some types of human food poisoning during pregnancy can cause complications, such as dehydration, for the pregnant woman or can affect the fetus. For example, human food poisoning by the bacterium *Listeria* can cause miscarriage or stillbirth. Elderly individuals also face a greater risk of contracting food poisoning because their immune systems may not respond quickly to infectious organisms. Individuals with chronic diseases also have been shown more susceptible to food poisoning. The presence of a chronic condition, such as diabetes, liver disease, or AIDS, or the undertaking of chemotherapy or radiation therapy for cancer, has been demonstrated to diminish immune response.^{10, 11}

The aim of this review is to explore the etiology of food poisoning, the signs and symptoms of food poisoning, laboratory tests that can be performed in cases of food poisoning, treatments for food poisoning, and how food poisoning can be prevented.

II. MATERIALS AND METHODS

For this review, literature sources such as scientific journals on search engines (PubMed and Google Scholar) and relevant national books were searched. The keywords used were "Food Poisoning", "Etiology", "Symptoms", "Clinical Diagnosis", "Treatment" and "Prevention" of Food Poisoning. Inclusion criteria were all reviews on Food Poisoning. Exclusion criteria were literature published more than 20 years ago. Information was collected, recorded and analysed to assess the validity and reliability of the literature.

III. RESULTS AND DISCUSSION

Causes of Food Poisoning

In general, there are 3 factors that cause food poisoning. First is the patient factor or immunity, environment factor and food factor or the etiology or bacteria that contaminate the food. Patients who are immunocompromised are susceptible to food poisoning. Children and elderly are group of people who are high risk of food poisoning. Other groups who are also susceptible are those who had chronic illness, unfit condition or irregular food intake.¹²

Food that supposed to be the source of macro and micronutrients can be dangerous if contaminated and cause food poisoning. The problem is that sometimes we cannot identify the condition of food before we eat. If the food has changes in form and smell, then obviously we should not eat it.¹² There are two different types of contaminants in the food responsible for causing food poisoning. First, microbial contaminants (living agents) and the second is non microbial contaminants (non-living agents).^{3, 9}

Microbial contaminants include:

1. Bacteria - *Bacillus cereus*, *Staphylococcus aureus*, Salmonella group (except *S. typhi*), Shigella, Vibrio, *Escherichia coli*, *Campylobacter*, *Yersinia enterocolitis*, *Clostridium*.
2. Viruses – Rotavirus, Adenovirus, Parvovirus.
3. Protozoa - *Giardia lamblia*.
4. Fungi - *Aspergillus flavus*, *Fusarium roseum*.

Non-microbial contaminants include:

1. Vegetable origin - *Lathyrus sativus*, Mushrooms, *Argemone Mexicana*.
2. Animal sources - Poisonous fish like shellfish, scombroid fish etc. and Mussel.
3. Chemicals - Flavoring agents, Coloring agents, Preservatives

Bacteria is one of the main underlying causes of foodborne diseases. Noting that the symptoms of a bacterial infection are delayed because the bacteria need a period of time to multiply. It is often hidden and not seen until 12 - 72 hours or more after eating the contaminated food.¹ 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.^{9, 13} *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 *Escherichia 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.^{9, 14} 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.

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.⁹

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.¹³

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 poisoning 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*.⁹

Symptoms of Food Poisoning

There is no definite time limit when symptoms of food poisoning are felt by the patient after consuming a toxic or contaminated food. The delay between the consumption of contaminated food and the appearance of the first symptoms of illness is called the incubation period. 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. 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 live bacteria. The long incubation period of many food poisoning 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.^{10, 15}

Bacteria are the most prevalent cause of food poisoning. Toxins from bacterial infections are delayed because the bacteria need time to multiply. As a result, symptoms associated with intoxication are usually not seen until 12–72 hours or more after eating contaminated food.¹⁰ The symptoms of food poisoning caused by bacteria often simulate intestinal fluke and they may last a few hours or several days. Typical symptoms include diarrhea, vomiting, abdominal cramps, headaches, nausea, dry mouth, difficulty swallowing, and fluke-like symptoms (such as fever, chills, backache). Food poisoning by *Staphylococcus aureus* occurs for 2 - 4 hours. The symptoms are characterized by vomiting and diarrhea but no fever. The illness lasts less than 12 hours. In severe cases, dehydration, masked pallor, and collapse may require treatment (intravenously) infusion.^{3, 16} The incubation period of *Clostridium botulinum* is 12 - 36 hours. The symptoms which are generally caused by food poisoning are vomiting, dehydration, the mouth should be dried, hardened in feces, ocular paresis

(blurred-vision), problem in speaking, also found some difficulties in breathing and consumption of food which causes death within 7 days due to respiratory paralysis. The incubation period of *Clostridium perfringens* is 8 - 24 hours. The illness symptoms are acute abdominal pain, diarrhea, and vomiting, the illness is self-limiting, and the patient recovers within 8-24 hours. The classic symptoms of *Clostridium perfringens* type A food poisoning are diarrhea with lower abdominal cramps. Vomiting is not common, and fever is rare. The incubation period of *Escherichia coli* is 72 - 120 hours. The clinical sign may be diarrhea with abdominal cramps, which may turn into grossly bloody diarrhea in a few days and no fever occurs. The symptoms are shown due to Campylobacteriosis diseases are usually flu-like: fever, nausea, abdominal cramping, vomiting, enteritis, diarrhea, and malaise. Symptoms of food poisoning begin within 2-5 days due to ingestion of the bacteria, and the illness should occur in the last 7-10 days. Some individuals may develop Guillain Barré (GB) syndrome, a nerve disorder that causes muscle weakness and paralysis of the limbs, about 2 - 4 weeks after infection. The symptoms are shown due to Shigellosis are abdominal pain, cramps, diarrhea, fever, vomiting, blood, pus, or mucus in stools and tenesmus. Low-grade fever is caused by mild infections about 38 to 38.9°C and after ingestion of bacteria watery diarrhea occurs after 1 to 2 days. Children, particularly young children, are most likely to have severe complications High fever (up to 41°C), sometimes with delirium.^{10, 17, 18, 19}

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. 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.^{20, 21}

Viral infections make up perhaps one third of cases of food poisoning in developed countries. 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. Foodborne viral infection are usually of intermediate (1 - 3 days) incubation period, causing illnesses which are self-limited in otherwise healthy individuals.¹⁰ Enterovirus is entered into the host with contaminated water or food and multiplies in the digestive tract. Symptoms of the infection enterovirus caused by are often slight, moderate but almost all enterovirus infections are asymptomatic. Diseases that are caused by viruses are showing a serious problem or it causes death due to paralysis and aseptic meningitis.^{3, 22} The symptoms caused by rotaviruses are frequent coinfection of astrovirus with rotavirus and caliciviruses in childhood diarrhea complicates the epidemiology. Infections are more common in winter. Non enteric symptoms can often be observed in grown-up children on numerous occasions (subfertility, headache, etc.). The symptoms that should occur due to the viruses are fever, vomiting, the red ulcerative injury that should be found on the oral tissues, and vesicular injury found on the skin of the body. The symptoms caused by Norovirus are vomiting and diarrhea, (rarely) convulsion, and others. Asymptomatic infections are common and may contribute to the spread of the infection.²³

Some toxins cause symptoms within seconds, while others cause symptoms only hours, days, or even years later. Some toxins cause such obvious symptoms that vital organs, such as the kidneys or liver, are sometimes permanently damaged. Ingested (ingested) and absorbed toxins cause symptoms throughout the body because they often deprive the body's cells of oxygen or activate or block the action of enzymes and receptors. Symptoms may include changes in consciousness, body temperature, heart rate and breathing, and a number of other symptoms, depending on which organs are affected. Caustic or irritating substances Injury to the mucous membranes of the mouth, throat, digestive tract, and lungs causes pain, coughing, vomiting and shortness of breath. Skin exposure to toxins can cause various symptoms, such as rashes, pain, and blisters. Also, prolonged exposure to toxins can cause skin inflammation. Eye exposure to toxins can damage the eye, causing eye pain, redness, and decreased vision. The consumption of poisonous mushrooms leads to mycetism, while consumption of food contaminated with toxin-producing fungi leads to mycotoxicosis.^{1, 24}

Classic symptoms of food poisoning are typical of gastroenteritis include diarrhea, nausea, vomiting and abdominal pain. These symptoms can occur in any combination; they generally have an 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 poisoning.¹⁰ The symptoms of food poisoning must not be ignored if persist for a longer time. It has been reported that sometimes, food poisoning may be life threatening. If any person suffers any of the following symptoms, it is recommended that person must consult the doctor as soon as possible.⁹

- 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
- Severe diarrhea persisting more than a couple of days
- Visibility of blood in the urine (hemolytic uremic syndrome)

Dehydration is the most common complication of hazards causing human food poisoning. When human food poisoning causes vomiting or diarrhea, the body loses fluids and electrolytes. If the body doesn't replace those fluids and electrolytes, the body may become dehydrated. When the body is dehydrated, the body doesn't have enough fluid and electrolytes to work properly. Dehydration is especially dangerous in children, older adults, and people with weakened immune systems. If the body is dehydrated, see a right away to prevent dangerous health problems. Without treatment, dehydration can lead to problems such as organ damage, shock, coma, or even death.⁶

Hemolytic uremic syndrome (HUS) is a kidney condition that happens when red blood cells are destroyed and block the kidneys' filtering system. If the kidneys stop working, the body has acute kidney injury the sudden and temporary loss of kidney function. The most common cause of HUS is infection with a strain of *Escherichia coli* (*E. coli*) bacterium called *E. coli* O157:H7, although other bacteria and viruses may also be hazards causing human food poisoning cause this condition. Hemolytic uremic syndrome is most common in children less than five years age.^{6, 25}

Clinical Diagnosis of Food Poisoning

Mostly physicians diagnose food poisoning on the basis of symptoms like abdominal cramps, vomiting and/ or diarrhea. 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. The physical examination can help narrow the differential diagnosis, and vital signs can help determine the severity of poisoning. Orthostatic pulse and blood pressure changes should be noted, and a basic general physical examination should be performed, with assessment of skin turgor, the abdomen, mucous membranes, and mental status.²⁶

Laboratory testing is usually not necessary. If testing is performed, stool culture can provide a definitive diagnosis of infectious diarrhea and is useful for outbreak identification. A positive stool culture is more likely when analysis indicates an inflammatory process. Compared with leukocyte examinations, lactoferrin measurements are more sensitive but more expensive, have a higher false-positive rate, and require a fresh-cup sample examined by an experienced microscopist. Bacteria are the most common cause of non-self-limiting foodborne illness; however, stool cultures are positive in less than 40% of case. Stool microscopy is rarely diagnostic, but the presence of red and white blood cells may signal a colonic source. Its primary use is identification of ova, cysts, and parasites, although antigen testing is more sensitive and specific for *Giardia*. Microscopic evaluation for fecal polymorphonuclear leukocytes or lactoferrin measurements may be useful if an inflammatory etiology is suspected. Newer techniques such as Polymerase Chain Reaction (PCR) testing have become readily available and provide more rapid, reliable determination of specific pathogens. Other tests that can be considered include serum chemistry (including albumin levels), C-reactive protein levels, complete blood count, blood cultures, urinalysis, abdominal radiography, anoscopy, and endoscopy, if warranted by the severity and pattern of symptoms. In severe cases of infectious diarrhea, toxic megacolon should be considered, which can be identified on plainabdominal radiography. Severe inflammatory changes can also be seen on computed tomography. It may be reasonable to obtain blood cultures in patients with fever and diarrhea (with or without blood), because up to 1% of cases of nontyphoidal *Salmonella* infections are associated with bacteremia. Sigmoidoscopy or colonoscopy may be useful in hospitalized patients with bloody diarrhea to obtain tissue and histology, which could aid in the diagnosis.^{26, 27, 28}

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. It's important to avoid dehydration by drinking plenty of water to replace any fluids lost through vomiting and diarrhoea. However, if patients are not responsive to rehydration, patients should be hospitalized to be re-hydrated by

intravenous line. Most physicians 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. Empirical therapy with antibiotics may be considered in high risk patients such as elderly, immunocompromised, diabetes, liver cirrhosis or intestinal hypomotility.^{9, 10, 11}

1. Symptomatic Treatment

Use of antidiarrheal medications, including antimotility agents, anticholinergics, and adsorbents, is not recommended in children, especially those younger than two years, and is discouraged if infection with Shiga toxin– producing *E. coli* is suspected. Symptomatic treatment with loperamide (Imodium) and bismuth subsalicylate (Pepto-Bismol) is effective and may be considered in adults with uncomplicated acute or traveler’s diarrhea. Although loperamide is more effective than bismuth subsalicylate, it is not recommended for patients with hematochezia and systemic symptoms because it may increase the risk of invasive disease. In patients with clinically significant vomiting, antiemetics can alleviate symptoms and reduce the need for hospitalization and intravenous fluid administration. The use of antiemetics in adults with gastroenteritis is reasonable, but data about adverse effects are lacking.^{26, 29, 30}

2. Dehydration

Many physicians are reluctant to use oral rehydration therapy, despite its proven effectiveness in the management of diarrhea-associated dehydration. It has been proven to prevent and treat dehydration in patients of all ages. Oral rehydration solutions contain a blend of electrolytes, as well as carbohydrates. Sports drinks and soft drinks have a high carbohydrate-to-sodium ratio and total osmolality, and can exacerbate diarrhea. Clinical assessment should be used to guide rehydration therapy. Children—especially infants—are predisposed to dehydration and require more diligence in determining hydration status. CDC guidelines recommend the initial use of oral rehydration therapy with replacement of continuing fluid losses in children with mild to moderate dehydration. Children with severe dehydration should be hospitalized and given intravenous fluids. When oral rehydration therapy or intravenous fluid administration is used in infants, care should be taken to minimize interruptions in breastfeeding or formula feeding.^{26, 29}

3. Empiric Antibiotics

Most cases of acute infectious diarrhea are viral, and improper use of empiric antibiotics is associated with increased morbidity caused by adverse effects. Empiric antibiotics should be considered in cases of suspected foodborne illness only if the patient is febrile and has signs of invasive disease (e.g., gross hematochezia, leukocytes on fecal smear), if symptoms have persisted for more than one week or are severe (i.e., more than eight liquid stools per day), or if hospitalization may be required. A fluoroquinolone (or trimethoprim/ sulfamethoxazole in children) is generally recommended for empiric antibiotic therapy. Stool testing should still be performed. Empiric antibiotic therapy decreases the duration of symptoms in patients with traveler’s diarrhea. Enterotoxigenic *Escherichia coli* is the most common cause of traveler’s diarrhea worldwide and is generally susceptible to ciprofloxacin, but azithromycin is equally effective and a better choice in areas where fluoroquinolone-resistant *C. jejuni* is present. Patients with diarrhea of more than 10 days’ duration that is associated with fatty or foul-smelling stools, cramps, bloating, and weight loss can be treated empirically for *Giardia* infection. Because of an increased risk of hemolytic uremic syndrome, patients receiving empiric antibiotic therapy should be monitored closely if Shigatoxin–producing *E. coli* infection is suspected.³²

4. Targeted Antibiotics

If empiric treatment has not been initiated, antibiotic therapy may be indicated once stool culture, bacterial toxin, or microscopy results are available. Antibiotic therapy can shorten the duration of symptoms and may prevent bacteremia in older adults, newborns, and immunocompromised patients. Ciprofloxacin is no longer recommended for treatment of *Campylobacter* infection; a macrolide, such as erythromycin, is recommended instead.²⁶

Prevention of Food Poisoning

Prevention is always better than cure the disease. Information to prevent food contamination should be well-socialized to general community continually. In general, most of the bacteria, parasite and viruses get killed on heating at higher temperature. It is always preferred to consume food after cooking at or more than 70°C temperature. 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. 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.⁹

Some important factors to consider are that food must be well-cooked to kill bacteria during the cooking process. Food should not be left out at room temperature for too long. Cook food at a high temperature to kill dangerous bacteria. Prevent cross-contamination of food. For example, a knife used to cut raw meat or seafood should not be used again to cut cooked food, and the food preparation area should always be kept clean. Prevent well-cooked food from being contaminated by raw meat or seafood. Maintain warm food at a warm temperature and cold food at a cold temperature. The temperature of warm food should be kept above 65^oC, and it should be heated to 85^oC before serving. Store food in the refrigerator at an appropriate temperature. If food is left out at room temperature for too long, it is more likely to be contaminated by bacteria and become dangerous. Do not defrost food at room temperature. Defrost in the refrigerator, under running water, or in a microwave. Place packaged food or drinks according to the instructions written on the product. For example: It should be stored at a temperature between 2 and 8^oC, placed in the freezer, or stored at room temperature, but not exposed directly to sunlight.¹¹

To prevent food poisoning at home, always wash hands, utensils, and food surfaces frequently. Wash 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. Keep raw foods separate from ready-to-eat foods. Cook foods to a safe temperature. Promptly refrigerate or freeze perishable foods within two hours of purchasing or preparing them. Defrost food safely. Do not thaw food at room temperature. The safest way to thaw food is to defrost it in the refrigerator. Throw food out when in doubt. Food left at room temperature for too long may contain bacteria or toxins that cannot be destroyed by cooking. In food pre-processing, industrial processes also play an important role in increasing viral infection because some viral infections are present at the time of food processing. Another approach for inactivating viruses with adequate heating at the portion of food is relatively unreliable. The viruses which are present in water are exposed on the surface and inactivates with strong oxidizing agents or with ultraviolet light.³

IV. CONCLUSION

Food that supposed to be the source of macronutrients and micronutrients can be dangerous if contaminated and cause food poisoning. In general, there are 3 factors that cause food poisoning. First is the patient factor or immunity, environment factor and food factor or the etiology or bacteria that contaminate the food. Two different types of contaminants in the food responsible for causing food poisoning. First, microbial contaminants (living agents) and the second is non microbial contaminants (non-living agents). Microbial contaminants include bacteria, viruses, protozoa and fungi. Meanwhile non-microbial contaminants include vegetable origin, animal sources and chemicals. Classic symptoms of food poisoning are typical of gastroenteritis include diarrhea, nausea, vomiting and abdominal pain. These symptoms can occur in any combination; they generally have an acute onset 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. The symptoms of food poisoning must not be ignored if persist for a longer time. It has been reported that sometimes, food poisoning may be life threatening. Mostly physicians diagnose food poisoning on the basis of symptoms. The physical examination can help narrow the differential diagnosis, and vital signs can help determine the severity of poisoning. If laboratory testing is performed, stool culture can provide a definitive diagnosis of infectious diarrhea and is useful for outbreak identification. In stool microscopy the presence of red and white blood cells may signal a colonic source. Newer techniques such as PCR testing provide more rapid, reliable determination of specific pathogens. Other laboratory tests that can be considered include serum chemistry (including albumin levels), C-reactive protein levels, complete blood count, blood cultures, urinalysis, abdominal radiography, anoscopy, and endoscopy. Food poisoning can usually be treated at home without seeking medical advice. Physicians prescribe antidiarrheal medications, oral rehydration therapy, or empiric antibiotic, targeted antibiotics in food poisoning. Prevention is always better than cure the disease. Information to prevent food contamination should be well-socialized to general community continually. It is always preferred to consume food after cooking, always preferred to wash foods thoroughly before eating to washout microbial contamination, and washes the hands before touching or cooking the food and before taking any meal.

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