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A Review on Bacterial Food-Borne Disease

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Abstract

Food-borne illness are diseases happened because eating polluted water or nutriment containing microbes or their toxins. This paper reviews previous studies of foodborne illness, particularly foodborne illness happened because bacteria which represent 66% of problems. Vibrosis, Shigellosis, Bacillosis, Listerosis Salmonellosis, Botulism, and staphylococcal food poisoning are the main dietary disease happened because of bacteria. Bacteria in nutrition will increase beneath optimal cases and secrete poison in nutrition. After swallowing, poisons were absorbed by Intestinal epithelial lining that make natural harm to tissues. In certain cases, poisons are transmitted to tissues or devices like the central nervous system, kidney nor liver where they can cause damage. Foods carried diseases are divided into two collections which are food infection and poisoning. Food infection is happened because eating food, including fertile pathogens that secrete toxins in the intestine only, while poisoning is acquired by eating poison formed by pathogens (secrete toxins directly in the food). The most clinical sign of food poisoning are abdominal cramps, diarrhea, vomiting, nausea, and headache. Diagnosis of foodborne illnesses carried by a patient's record and the symptoms. Protection of foodborne diseases can be depended on food safety control during the production, processing, and distribution, secession of uncooked from cooked food, cooking carefully, and save food at a safe temperature.

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INTRODUCTION

Foodborne disease is an illness result from the exhaustion of a wide variety of food and polluted water with pathogenic creatures, their toxins, or chemicals. They must be occurred when an acute disease with neurological or gastrointestinal symptoms on affect persons who have shared a meal during 2-3 days ago. Outbreaks of bacterial foodborne illness are common during summer while perishable foods are placed in the kitchen or executed without cooling (World Health Organization, 2015). Many microbiologists believe that bacterial food intoxicating, unlike food contagions, while other microbiologists consider food intoxication like food infection. In bacterial food intoxicating, germs produce toxins in the food before exhaustion, while food contagion, food is the only carrier for germs (Center for Disease Control and Prevention, 2011; World Health Organization, 2015). Foodborne disease happened because bacteria or several chemicals existing in swallowed food although there are useful bacteria which are utilized for the produce of yogurt and cheese. Many chemicals which causes food poisoning are normal food contents, whereas another possibly putting through processing and production. The common reasons food poisoning are bacteria (66%), Chemical substances

(26%), parasites (4%), viruses (4%). Foodborne illness is divided into two types, poisoning, and contagion. Poisoning is acquired from eating the poison that happened from pathogens, whereas contagion is acquired from eating food, including fertile pathogens (Center for Disease Control and Prevention, 2011; World Health Organization, 2015). Some bacteria can grow on the food, producing secondary metabolism products such as toxins, that pose a health risk for the consumer. Contamination of Food can be obtained from animals, plant, sewage, soil, air, or food handlers (Thomas *et al.*, 2015). Clinical signs of foodborne illness similar to the intestinal disease include vomiting, nausea, abdominal cramps, headaches, and diarrhea. In some cases, can result renal and hepatic syndromes eventually leads to death (Scallan *et al.*, 2011). Food poisoning may be prohibited during sufficient cooking and processing of food that destroys bacteria like heat processing of food at the appropriate temperature, sufficient refrigeration, personal hygiene, and avoid save of food in the heating machine at appropriate temperatures to increase bacteria. In contrast, deficient cooking, and bad storing maybe let bacteria to grow in food that might be relies on PH, water activity, food condition and storing time (Ogori and Utim, 2013). The safety of food become source of anxiety in world essentially in developing countries, wherever produce of food happening in unhealthy cases. Therefore, this paper was designed to review previous studies on bacterial foodborne illnesses (Chillab *et al.*, 2019).

Bacterial foodborne diseases

Food-borne illnesses may be divided into two types: Intoxication and contagion. Intoxication is acquired through eating poisons created through microbes, whereas

contagion is acquired through the eating of food which have fertile microbes. (World Health Organization, 2017; Al-Awsi *et al.*, 2019; Chalap and Al-Awsi, 2019; shamran *et al.*, 2018).

Food intoxication

Ex1: Staphylococcal food intoxication

Pathogens**:** *Staphylococcus aureus* is real food intoxication bacteria. It is gram-positive cocci, appears under a microscope in grape-like clusters. It generates poison stable heat in some foods while growth in 2-4 hours. Poison is not influenced through freezing or heating like it heats stable. If food is warmth before feeding, toxin in food will bring disease though the kill of bacteria by heat (Quinn *et al.*, 2011). *S. aureus* is generally present in the skin and nasal passages of the most human and enter into the food during production from sneezes or wounds on workers' hands. This bacterium grows best at pH 4.5. Therefore, it presents in sour foods like pickles and tomatoes. Storage of food at room temperature for some time allows the bacteria in the food to produce toxins. *S. aureus* is produced 6 serologically kinds of intestinal toxins (A, B, C1, C2, D, and E). Many food intoxication happened because enterotoxin that is heat stable. Staphylococcal enterotoxins induce vomiting center in central nervous systems and reduce sodium and water absorption in the small intestine. Intestinal toxins may be specified through the gel spread way (Quinn *et al.*, 2011; Ramachandran, 2014). Major Symptoms of poisoning is characterized by vomiting and diarrhea, headache, nausea, stomach cramps (2-4 hours after eating), but no fever. The disease is a result of the swallow of toxins in the food. Prevention of Staphylococcal food poisoning includes the following: good cooking, Proper cooling food, personal cleanliness, and thermal processing. Observation of Staphylococcal food poisoning includes: take proper personal measures in prepare of the food, prevent persons with skin lesions from processing food and putting food at 4 °C so as to stop bacterial growth and creating of poison (Abdulhussein and Al-Awsi, 2019).

Ex2: Botulism Food Poisoning

Pathogens**:** *Clostridium botulinum* is gramme positive rods, anaerobic bacteria which forms a heat resistant spore. Strains of *C. botulinum* are categorized based on serological specificity and neurotoxin into four sets, include I, II, III, and IV sets. Series I contain the proteolytics, series II is the non-proteolytic, series III consists of serological kind (C, D) and series IV consists of serological kind G. (Luvisetto *et al.*, 2015). The growth of *C. botulinum* is based on pH of tinned food. Fruits will not allow their growth because of pH (less 4.6), while the vegetables are not sour foods and will permit its increase (pH above 4.6). So as to poison expand, temperature through tinning should be insufficient to kill spores. *C. botulinum* produces 7 types of poisons. Kinds A, B, and E are associated with human diseases. Produce of neurotoxin during the growth of *C. botulinum* cause neuroparalytic disease. Botulism can bring death because of paralysis of the respiratory muscles (J M Jay, 2000). Botulism neurotoxin is absorbed from glands in the stomach and small intestine or injury and moved by the blood current and enters nervous cell then to the neuromuscular junction, peripheral ganglion and Parasympathetic nervous system. Intensive strings of the neurotoxin is bind to senses and enters into cell, while sprightly strings prevents leave of

acetylcholine at the intersection of nerve muscles, then causing flaccid paralysis because of shortage of acetylcholine, influence muscle of breathing that lead to respiratory fail then death (J M Jay, 2000). The most common clinical signs of botulism include vomiting, dry of mouth, optic paralysis, constipation, awkwardness in respiration, swallowing and speaking. Death exists because of respiratory paralysis during 7 days. Botulism consider as a lower motor neuron disease resulting in flaccid paralysis. (Morris and Fernández-Miyakawa, 2009). Detection of toxin by the ELISA test is less sensitive than mouse bioassay. The spoilage of food, bubbles inside can, or swelling can indicate the growth of *C. botulinum*. Food is cultured in blood agar and incubated anaerobically at 37°C for 3-5 days. The toxin can be identified by injecting the mice or guinea pig within the bacterial culture (Morris and Fernández-Miyakawa, 2009). To prevent botulism**:** check the home-canned foods and use a Proper temperature and processing time in home canning foods. Toxins in food can be destroyed by exposure to boiling for 10 minutes. Therefore, before the consumption of canned, low acid foods should be boiled. Prevention of botulism also depends on the control of spores in canned food by cooking at 121°C. Home-canned vegetables should be boiled for at least 3 minutes prior to eating to destroy toxins and avoid foods with apparent off-odors (J M Jay, 2000).

Food Infection

Ex1: Salmonellosis

Pathogens**:** *Salmonella* spp. Is gram-negative rods, non-spore forming. *Salmonellosis* is the most common of food transmitted diseases result from the consumption of polluted foods with *salmonella* spp. like milk, cheese, eggs, meat, pastries, cakes, this called food infection (Minor *et al.*, 1987). *Salmonella* enters the host body by ingestion, then moves into the small intestine, keeps increase, and expands. Outcome is disease after 8- 24 hours of eating the contaminated food. In systemic infections, the entry of salmonella often occurs without mucosal damage, while the enteric infection is occurring local damage without septicemia. (Aung and Chang, 2014). Clinical symptoms of Salmonellosis are characterized by watery diarrhea, greenish with foul-smelling, headache, chills, muscle weakness, and fever. The symptoms disappear after 3 days without any complication (Thomas *et al.*, 2015). These Clinical signs may be sharp, essentially in elderly and children. Symptoms appear 12-72 hours after entry to the bacterium and last up to a week. osteomyelitis, interactive arthritis, and sickle-cell anemia because of contagion with salmonella (J M Jay, 2000).

In general, identification of *salmonella* spp. It can be through utilized of eclectic fecundity media like *salmonella-shigella*, agar, and incubation at 37^{o}C for 24 hours, growth is identified by biochemical and serological tests (Aung and Chang, 2014). Prevention of Salmonellosis by cooking that kills bacteria. illness often occurs because of the pollution of food after cooking. Cooked food must not be prepared on cutting equipment used to ready uncooked material (Quinn *et al.*, 2011). Thermal processing of food includes pasteurization of milk, irradiation of meat, good cleanliness through the production of food, pollination of food-producing animals, and egg-producing chicken. Safe food preparation involves cooking and reheat of food, pasteurization of milk, sufficient cooling, disinfection of food preparation surfaces and avoids animals in the food handling area (J M Jay, 2000; Ewaid *et al.*, 2019a,b).

Ex2: *Clostridium perfringens* food infection

Pathogens**:** *Clostridium perfringens* is gram-positive rods, spore-forming anaerobic. It isn't killed by boiling which is existent in vegetation, milieu and animal stools. *C. perfringens* is different from other food poisoning bacteria because it produce enterotoxin in the gastro-intestinal tract after its consuming and also causes a food infection (Morris and Fernández-Miyakawa, 2009). Germs in food cannot killed by cooking and grow while storage in inappropriate conditions. Vegetative cells of bacteria form spore in the intestine. They leave the intestinal (Center for Disease Control and Prevention, 2011). The enterotoxin *C. perfringens* (CPE) is not like staphylococcus enterotoxin. Food infection started while the enterotoxin link to senses on epithelial cells in digestive. It centralize in the plasma membrane and connected with a protein in the membrane to make a major composite. Membrane permeability alterations induced by CPE leads to death of cell from lysis or metabolic disorders (Ramachandran, 2014). The common clinical signs of illness include: diarrhea, acute abdominal pain, vomiting, and fever is scarce. Symptoms exist in 12-24 hours after eating foods, including vegetative cells of bacteria. They reduce after 1-2days, though the cramps maybe keep going for a long time (Robinson *et al.*, 2000). To detection of *C. perfringens* and their enterotoxin: homogenized food is diluted, streaking on selective medium and incubated anaerobically at 37°C for 7 days. Produce of enterotoxin can be identified by injecting the laboratory animals (mice or guinea pig) within the bacterial cultures (Quinn *et al.*, 2011). Gastroenteritis caused by *C. perfringens* may be prevented through cook meat at above 74^{o}C. Use refrigeration for storage, wash, and disinfection of all equipment and containers that contacted

with uncooked meat/eggs cleans hands, and utilize plastic leaper while processing raw foods. Cooking at 100^{o}C will permit existence of spores, operation reduce oxygen's and producing in foods anaerobic cases. Therefore, the practical method of forbidding *C. perfringens* foodborne disease by killing the vegetative cells (Robinson *et al.*, 2000).

Ex3: *Escherichia coli* food infection

Pathogens**:** *Escherichia coli* is a gram-negative rod, motile, facultative anaerobe, the ferment of lactose sugar produces pink colonies on MacConkey agar and hemolysis of RBC on blood agar (J M Jay, 2000; Quinn *et al.*, 2011). *E. coli* O157: H7 is a major serotype that cause a diversity of human diseases like hemorrhagic colitis, hemolytic-uremic syndrome (HUS), and diarrhea (Aung and Chang, 2014). EHEC sprain can be production one or more kinds of shiga-like toxins (SLTs). The toxins induce cells secretion and damage the epithelial colon cells (J M Jay, 2000). EHEC are characterized by the presence of virulence factors includes SLTs genes, LEE, and plasmid which symbolizes for a bloody, these risk factors associated with HUS and bloody diarrhea in humans (Ramachandran, 2014). The common virulence factor of O157: H7 is the production of shiga-like poisons. The shiga-like toxins of *E. coli* O157: H7 are cytotoxic to human ileum cells and colon cells (Robinson *et al.*, 2000). The clinical symptoms initially involve diarrhea with colic, that can be converted into bloody diarrhea and without fever. Clinical symptoms of *E. coli* blood poisoning are belonging to bacteremia and blood poisoning. Techniques that can be used to detect SLT include ELISA technique, DNA hybridization techniques, and immunoassay techniques. *Escherichia coli* food infection may be stopped by the same mechanisms as the prohibition of other food poisoning happened because of bacteria (Ewaid and Abed, 2017).

Ex4: Shigellosis

Pathogens**:** *Shigella* sp. is a type of intestinal bacteria which cause human illness. It is gram-negative rods, non-motile, facultative anaerobes that are non-spore forming (J M Jay, 2000; Ramachandran, 2014). *Shigella* sp. adhere and hacked cell walls of small intestines by producing Shiga toxin. Shiga poison permits bacteria to penetrate intestinal epithelial lining leads to destroy of liner and hemorrhage. *Shigella* sp. has substances that allow link to epithelial cell and antigens of invasion plasmid, which promote bacteria to step inside target cells (Scallan *et al.*, 2011). The common symptoms of shigellosis include: diarrhea with pus in stools, fever, vomiting, blood, abdominal pain and cramps. Mild infections cause watery diarrhea with low fever 1 -2 days after eating bacteria. Colic and a repetitive desire to defecate are mutual with more sharp contagion. Common sharp contagion might because of mild fever, watery diarrhea which development to diarrhea and abdominal cramps. In dysentery, patient stools include blood, pus, and mucus. Young children possible to have sharp multiples of strong fever with delirium, dehydration with sharp diarrhea, bump of the rectum out of the body, maybe swelling of the intestine and perforation in the large intestine (Scallan *et al.*, 2011; Akhtar *et al.*, 2014). Shigella infection is identified by stool examination. First, a litter should be collected from the infected people, and then streaking on selective center. Bacteria are identified under a microscope (Scallan *et al.*, 2011). *Shigella* can be killed by thermal processing at 70^{o}C. Raw foods and transmission of pollution, contact of cooked items with uncooked materials or polluted materials are the main reasons of contagion. Good cooking and healthy food treating can stop shigellosis. The effective method for the prevention of shigellosis is hand washing with soapy, warm water, and safe sewage disposal in developing countries and provide clean drinking water sources (Akhtar *et al.*, 2014).

Ex5: Campylobacteriosis

Pathogens**:** *Campylobacter jejuni* is a negative gram-shaped rod, motile, non-spore formation, microaerophilic bacteria, destroyed by high temperatures and don't tolerate acidic PH. It is responsible for 15% of foodborne illness (J M Jay, 2000; Ramachandran, 2014). The virulence factors of *C. jejuni* involve motility, toxin production, colonization, attachment, and translocation. Food contagion started with the consumption of *C. jejuni* in polluted foods or water. The bacterium reaches small and major intestines to increase, then pervade the epithelial cells in intestines (Quinn *et al.*, 2011). The common symptoms connected with campylobacteriosis are flu: vomiting, sickness, fever, abdominal cramping, diarrhea and queasiness. Symptoms appears during 2-5 days after consumption of *C. jejuni* in contaminated foods, and the disease lasts from 7-10 days. Complications of infection can include: meningitis, arthritis, urinary tract infections, and Guillain Barré syndrome (Scallan *et al.*, 2011). The diagnosis of *C. jejuni* is depended on the separation of bacteria on eclectic media within microaerophilic cases. PCR techniques are active in distinguish contagion (J M Jay, 2000). A number of *C. jejuni* may be controlled and reduced in eating plants through the washing and freeze of corpses. The perfection of food- processing in kitchens will decrease the transport of bacteria, and the proper cooking of

uncooked meat at 82°C will eliminate *C. jejuni*.

Ex6: Listeriosis

Pathogens**:** *Listeria monocytogenes* is a tiny gramme favorable, non-spore formation rod an optional anaerobic bacterium. It is one of the virulent food-borne pathogens that can reproduce and grow inside the host's cells (J M Jay, 2000). *L. monocytogenes* infect mucous membranes of intestines, like within the cells contagion through protein of bacteria "internalin" adhere to an albuminoid of intestinal cell membrane "cadherin." then, It can pass across the intestinal cell membrane into the body. *L. monocytogenes* can be infected gastrointestinal epithelium and enter inside host macrophages. It becomes septic. Its presence inside phagocytic cells allows access to the brain and maybe moving across the placenta to the embryo (Scallan *et al.*, 2011). Symptoms of listeriosis commonly from 7-10 days being a fever, muscle pain, vomiting, or maybe diarrhea. It can cause meningitis if contagion reaches to the central nervous system (Thomas *et al.*, 2015). The identification of *L. monocytogenes* in food through inoculate of selective broths and incubated at 4°C for 8 weeks, ELISA and DNA probe. The means of prevention of Listeriosis is the improvement of safe handling, washing raw vegetables, good cooking, reheating foods and refrigeration of foods in house at less than 4°C to inhibit the bacterial growth (J M Jay, 2000).

Ex7: Vibriosis

Pathogens*: Vibrio parahaemolyticus* is a gram-negative, comma-shaped, halophilic organism. It is a food infection organism uncommon to many humans. This bacterium is often associated with shellfish or marine fish. The most symptoms of vibriosis include: vomiting, diarrhea, abdominal cramps, and nausea may result. To prevent food infection must be avoided of contaminated waters to fishermen, storage shellfish in refrigeration to prevent the growth of vibrio and good cooking for shellfish (Pal, 2014).

CONCLUSIONS

Bacterial food carry diseases are the most famous universal public health issues. Also, the real incidence rate of bacterial food carry diseases are unnamed for the following causes, faulty diagnosis of disease, insufficient sets of examples for lab tests, and inappropriate lab test. Pathogenic bacteria in foods poses concerns and health risk about the safety of food products where food contamination exist in each step of production or distribution operation. To prevent bacterial foodborne diseases must eliminate the bacteria-contaminated for the food through cleaning your hands before eating food, clean uncooked foods, good cooking foods, and reheat food quickly. It's the common responsibility of the consumer, trader and government to work together to implement laws that support food safety.

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