ANALYSIS OF THE ROLE OF PATHOGENIC E. COLI IN FRESH VEGETABLES

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Abstract

Many raw vegetables, such as tomatoes, peppers, onions, lettuce, arugula, spinach, and cilantro, are included in fresh dishes including ready-to-eat salads and sauces. E-coil consumption of these foods provides high nutritional value to the human diet. However, there are increasing numbers of foodborne outbreaks involving fresh produce, with Escherichia coli being the most common pathogen associated with them. In humans, pathogenic E. coli strains cause diarrhea, hemorrhagic colitis, hemolytic uremic syndrome, and other signs. Vegetables are contaminated with E. coli at any time from pre-harvest to post-harvest, a bacterium that is able to survive in many environmental conditions due to a variety of mechanisms, such as adhesion to surfaces and fresh Internalization in products, thereby limiting its usefulness. Traditional processing and chemical cleaning methods used by the food industry E. coli in ready-to-eat vegetable dishes, this information will contribute to the development of effective control measures to enhance food safety.

Keywords: Traditional, Bacterium, Vegetable, Development, Control, E. coli etc.

Introduction

Dr. Helge Karch of the University Hospital Münster in Germany has tried to identify the secret behind the spread of this bacteria. They think that it is a 'hybrid bacteria' with antibiotic resistance, which has become more dangerous than its parent bacterial 'parent'. His revelation has raised questions about all the systems being used in organic farming. It is a bitter truth of agricultural science that organic food is often infected with E-coli bacteria or there is always a possibility of them getting infected. Now such incidents of E-coli spread have again alerted us to this fact.

Organic food or organic food usually provides fertility with animal manure and E-coli also thrives in these places. According to the European Center above, such bacteria are found in the lower intestines of mammals. E-coli bacteria are mainly spread in Germany through fertilizers in organic farms or sewerage leakage in irrigation supplies or by the hands of workers who use those products/fertilizers.

Dr. Jonathan Fletcher, Professor of Microbiology at the University of Bedford, England, explains that if cow dung is used as a fertilizer, then there is every possibility that vegetables will also be infected with harmful bacteria. Therefore, there must be a strict provision of cleaning those vegetables i.e. washing them.

It is noteworthy that many studies have revealed the fact that organic vegetables have higher levels of E-coli than others. This is indeed an alarm bell. The World Health Organization has advised that everyone must wash their hands thoroughly after going to the toilet and before eating. Especially it is important to wash raw vegetables, fruits and salads with clean and fresh water before eating. It is advisable to eat well cooked or roasted vegetables.

E-coli is more prone to spread in a country like India, because most of the Indian farmers use only organic manures of non-composted animals such as cow dung. Apart from this, water for irrigation is also often supplied from polluted rivers.

According to the Central Pollution Control Board, the number of harmful bacteria in Yamuna is very high. According to the World Health Organization, the maximum possible number of bacteria in irrigation water is 500 mpn per 100 ml. Should not be more than Whereas the reality is that this number of harmful germs in Yamuna is 2,300,000,000 (MPN) per 100 ml. Is. This polluted water is used without treatment in the fields of Yamuna banks of Delhi. But not only Delhi, the entire agricultural system of India is on the verge of getting infected with E-coli bacteria.

E. coli and related bacteria constitute about 0.1% of the gut flora,[4] and fecal-oral transmission is the major route through which pathogenic strains of the bacterium cause disease. Cells are able to survive outside the body for a limited amount of time, which makes them ideal for testing environmental samples for indicator organisms for fecal contamination.[5][6] The bacterium can be easily and inexpensively grown in a laboratory setting, and has been extensively investigated for over 60 years. E. coli is the most widely used prokaryotic model organism, and an important species in the fields of biotechnology and microbiology, where it has served as the host organism for the majority of work with recombinant DNA. German pediatrician and bacteriologist Theodor Escherich discovered E. coli in 1885,[5] and is now classified as part of the gamma-proteobacteria family Enterobacteriaceae.[7]

Gastrointestinal Infections

E. coli, such as O157:H7, O104:H4, O121, O26, O103, O111, O145, and O104:H21, produce potentially lethal toxins. E. coli can be caused by food poisoning by eating uncooked vegetables or poorly chopped and undercooked meats. O157:H7 is also notorious for causing serious and even life-threatening complications such as hemolytic uremic syndrome. This particular strain has been linked to the 2006 United States E. coli outbreak caused by fresh spinach. The O104:H4 strain is equally virulent. Antibiotic and adjuvant treatment protocols for this are not as well developed (it has the potential to be very enterohemorrhagic, like O157:H7, causing bloody diarrhea, but is also more enteroaggregative, meaning it adheres well to and collides with the intestinal membrane). This is the strain behind the deadly June 2011 AD. coli outbreak in Europe. The severity of the disease varies greatly; It can be fatal, especially for young children, the elderly or the immunocompromised, but is more often mild. Before that, seven people had died in 1996 of E. coli poisoning, and left hundreds more infected, due to poor healthful methods of preparing meat in Scotland. E. coli can harbor both heat-retaining and heat-labile enterotoxins. The latter, called LT, consists of one A subunit and five B subunits organized into a holotoxin, and is similar in structure and function to cholera toxins. The B subunits aid in the penetration and penetration of the toxin into intestinal cells, while the A subunit is cleaved and prevents the cells from absorbing water, causing diarrhea. LT is secreted through the type 2 secretion pathway. [11]

If E. coli bacteria escape the intestinal tract through a perforation (for example from an ulcer, a ruptured appendix, or due to a surgical error) and enter the abdomen, they usually cause peritonitis. This prompt treatment. can be fatal without However, E. coli are extremely sensitive to such antibiotics as streptomycin or gentamicin. Recent research suggests treatment of enteropathogenic E. coli with antibiotics may not improve disease outcome,[citation needed] as it may significantly increase the likelihood of developing haemolytic-uremic syndrome.[12]

E. coli is observed in increased numbers in intestinal mucosal inflammation of the large intestine with inflammatory bowel disease, Crohn's disease and canker.[13] Invasive strains of E. coli are present in high numbers in inflamed tissue, and the number of bacteria in the inflamed areas is related to the severity of bowel inflammation. [14]

Gastrointestinal infections can cause the body to develop memory T cells to attack the intestinal microbes that cause intestinal stones. Food poisoning can trigger an immune response to microbial gut bacteria. Some researchers suggest that this may lead to inflammatory bowel disease. [15]

Epidemiology of gastrointestinal infections

Transmission of the pathogen E. coli is often by fecal-oral transmission.[19][20][21] Common routes of transmission include: unhygienic food preparation, [20] field contamination due to manure fertilization, [22] irrigating contaminated crops with gray water or raw sewage, [23] wild boar on cropland, [24] or sewage- Direct consumption of contaminated water. [25] Dairy and beef cattle are the primary reservoirs of E. coli O157:H7,[26] and they can carry it heterogeneously and excrete it in their feces. [26] Food associated with Products E. coli outbreaks include cucumbers, [27] raw ground beef, [28] raw seed sprouts or spinach, [22] raw milk, unpasteurized juice, unsweetened cheese by food workers infected via the fecal-oral route and contaminated foods. [20]

The U.S. Food and Drug Administration recommends preventing the fecal-oral cycle of transmission by properly cooking food, preventing cross-contamination, creating barriers such as gloves for food workers, and establishing health care policies so that the food industry's Seek treatment when workers are sick, pasteurization of juice or dairy products and proper hand-washing requirements.[20]

Shiga toxin-producing E. coli (STEC), specifically serotype O157:H7, has also been transmitted by flies, [29] [30] [31] as well as direct contact with farm animals, [32] [33]] Peat zoo animals, [34] and animal mites are found in animal husbandry environments. [35]

Survival conditions and persistence mechanisms

Some E. coli strains have been isolated from various plants used for human consumption, and these plants, such as spinach, lettuce, alfalfa, cress, bean, arugula, tomato and radish, are considered secondary hosts. These plants have physical barriers such as wax, cuticle, cell wall, trichomes and stomata (natural pores). It has been shown that some bacteria use stomata as entrances to the interior of the leaf. Many human pathogenic bacteria can survive and enter the plant interior in the apoplast; They can live in this environment with low metabolic activity, and they are able to survive drastic changes in temperature, pH, osmolality and nutrient deficiencies. Escherichia coli is a spontaneous member of the human and warm-blooded animal gut microbiota; However, pathogenic strains can cause intestinal and extra-intestinal infections.

These primary hosts can acquire E. coli from food contaminated with water and feces; Therefore, the presence of E. coli is used as an indicator of faecal contamination. Some E. coli strains have been isolated from various plants used for human consumption, and these plants, such as spinach, lettuce, alfalfa, cress, bean, arugula, tomato and radish, are considered secondary hosts. These plants have physical barriers such as wax, cuticle, cell wall, trichomes and stomata (natural pores). It has been shown that some bacteria use stomata as entrances to the interior of the leaf. Many human pathogenic bacteria can survive and enter the plant interior in the apoplast; They can live in this environment with low metabolic activity, and they are able to survive drastic changes in temperature, pH, osmolality and nutrient deficiencies.

Contamination factors in fresh vegetables

There are three types of factors affecting the microbiota present in fresh products: physical, chemical and biological. Physical factors, such as pH, temperature and humidity, influence the growth of the microbiota and certain metabolic activities. Chemical factors include availability in vegetables and nutrients that can be used by microorganisms. Finally, biotic factors include the presence of competitive microbiota and bacteria–plant interactions [24]. Fresh produce can be contaminated at any point in the production chain between farm and table. It has been shown that production contamination is high during three periods: in the field, during initial processing, and in the kitchen [25]. Agricultural factors (organic fertilizers, irrigation water, soil, and spraying of pesticides and insecticides) and post-harvest practices (handling, collection, washing, processing, transportation, and packaging) that can lead to contamination of raw vegetables by various pathogens Huh.

Microorganisms including E. coli. In addition, Lynch et al. found that intensive farming practices forced crop fields to be too close to animal production areas. The ecological consequences of this proximity have increased the potential for contamination by E. coli O157:H7 in wildlife: the percentage tested positive in unspecified ducks in Washington, USA was 5% (1/20 total samples); In large mammals including deer, such as the black-tailed deer (Odocoileus hemionus columbianus), it was 11.1% (1/9 of the total samples); In California, United States, in unspecified deer, it was 25% (1/4 of the total sample); In Ireland, in the wild pig (Sus scrofa), it was 14.9% (13/87 total samples); In California and in England in small mammals, such as the rabbit (Oryctolagus cuniculus), it was 48.8% (20/41 specimens in total). All sample types were feces, rectal and cloacal swabs, or gastrointestinal material from individual animals, unless otherwise noted. Weather is another important environmental condition that affects the spread of E. coli in vegetables. For example, E. coli contamination increased significantly in cilantro and parsley compared to that found in spring and winter. The discovery of E. coli in irrigation water has been linked to the presence of cattle and other animal feces, especially during heavy rainfall. There are current reports on outbreaks from consumption of lettuce irrigated with water contaminated with E. coli O157:H7. Another study suggests that well water used for irrigation may be contaminated with the feces of cattle or other animals with E. coli O157:H7, which can be seen especially during heavy rainfall.

Pre-harvest and post-harvest preventive measures for fresh produce

During pre-harvest, some pathogens can be transferred into the environment by the use of insufficiently prepared animal manure [10]. Therefore, it is necessary to use fertilizers that are properly "stable". One way to stabilize them is through the use of composting, in which organic matter is decomposed by the action of microorganisms at a specified temperature (131 °F) for a specified period of time (eg, 3 or 15 days), followed by A stage of treatment in cold conditions. These conditions reduce the levels of pathogenic microorganisms, promote the decomposition of cellulose and lignin, and stabilize their structure. Untreated human excreta should not be used to fertilize vegetables and crops for human consumption [27] unless it complies with the Specifications for the Use of Biosolids in accordance with the Regulation.

Water associated with irrigation systems is at risk of microbial contamination because of the relationship between the amount of water retained on the crop surface, the amount of food consumed, and the timing of harvest. Similarly, there is a recognized need to establish GAPs (Good Agricultural Practices) based on product safety standard protocols for irrigating fresh produce. After harvesting, wash water can be a transmission vehicle for pathogens, especially when this water is reused [28]. In addition, E. coli can survive in tap water for a relatively long time, which can have serious consequences for the health of consumers. This was revealed in incidents in the water supply system of Walkerton, Canada, which were caused by E. coli O157 : H7; Seven people died, and more than 2,300 people became ill. In addition, exposure to reclaimed water can be reduced through treatment and disinfection systems such as activated charcoal, reverse osmosis, membrane filtration, chlorination, ozonation, and UV irradiation; However, some systems are often expensive, especially in developing countries. As mentioned in the previous section, the food processing industry is using chemical decontamination (hypochlorite, peroxyacetic acid, organic acids, hydrogen peroxide, trisodium phosphate, and ozone) and physical decontamination (gamma radiation) of fresh produce ready to eat. . However, it has recently been reported that the nonthermal method of pulsed ultraviolet (PUV) light is a more effective method for reducing EHEC biofilms on fresh produce and packaging materials. A different strategy focuses on the use of plant commensal microbiota to compete with pathogens for dispersal factors or carbon sources in vegetative leaves and roots.

Recent studies are focusing on improving the efficacy of antimicrobial agents by exerting lethal activity on pathogenic microorganisms such as E. coli, especially focusing on the toxicity of reactive oxygen species (ROS) such as superoxide, hydrogen peroxide and hydroxyl radicals. These agents usually accumulate after exposing the bacteria to a stress agent, such as an antimicrobial. According to Hong et al., blocking ROS accumulation by exogenous suppressor agents in E. coli poststressor death, and they concluded that the lethal action of the agents depends in part on an amplified accumulation of ROS that exceeds primary damage repair.

Conclusion

The presence of enteropathogenic bacteria in fresh produce plays an important role in the emergence of foodborne outbreaks. There are many potential sources of contamination on fresh produce due to exposure to many different environments and handling. More studies are necessary to better understand how to prevent the occurrence of E. coli on fresh produce. Attachment to plant surfaces is the first step in the colonization process and subsequent transmission of pathogens through the edible parts of plants. However, each enteropathogen has its own molecular mechanisms of adherence and fitness to the vegetative biosphere; Many are similar to the mechanisms used to colonize the primary host. All enteropathogens survive in fresh produce for commercially relevant periods, despite the use of multiple disinfection systems. The future of food security lies in the adoption of strategies for different categories of E. coli pathogens. The presence of enteropathogenic bacteria in fresh produce plays an important role in the emergence of foodborne outbreaks. There are many potential sources of contamination on fresh produce due to exposure to many different environments and handling. More studies are necessary to better understand how to prevent the occurrence of E. coli on fresh produce. Attachment to plant surfaces is the first step in the colonization process and subsequent transmission of pathogens through the edible parts of plants. However, each enteropathogen has its own molecular mechanisms of adherence and fitness to the vegetative biosphere; Many are similar to the mechanisms used to colonize the primary host. All enteropathogens survive in fresh produce for commercially relevant periods, despite the use of multiple disinfection systems. The future of food security lies in the adoption of strategies for different categories of E. coli pathogens. These measures will help prevent bacterial transmission and benefit human health. Finally, producers, producers, packers and food consumers need to calibrate their processes and incorporate strategies to maintain food safety.

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