

## Indian Based Foodborne Diseases-A Discussion

Amit Kumar<sup>1</sup>, Manendra Kumar<sup>2</sup> and Nidhi Sharma<sup>3\*</sup>

<sup>1</sup>Food Microbiologist, Maharashtra Foods Processing and Cold Storage, Maharashtra, India

<sup>2</sup>Food Microbiologist, Haryana Test House and Consultancy Services, Haryana India

<sup>3</sup>Ph.D. Microbiology, Department of Microbiology, Janta Vedic Collage Baraut Baghpat, Uttar Pradesh, India

**\*Corresponding Author:** Nidhi Sharma, Ph.D. Microbiology, Department of Microbiology, Janta Vedic Collage Baraut Baghpat, Uttar Pradesh, India.

**Received:** January 17, 2019; **Published:** July 08, 2019

### Abstract

Bacteria can grow and multiply in the some types of foods and cause the foodborne illnesses. Foodborne bacteria are found naturally in the foods and other food products such as water, meat, fish, milk and other dairy products and it can grow in favourable conditions.

Some several bacteria such as *Salmonella species*, *Campylobacter jejuni*, *E. coli* and *Listeria monocytogenes*, *Staphylococcus aureus*, *Bacillus cereus* and *Clostridium species* can cause food infection. *Salmonella* is the most common bacterial species that cause foodborne disease, and its common sources are meat, egg, sea foods and milk. *Staphylococcus aureus*, *Clostridium botulinum* and *Clostridium perfringens* bacteria produce a toxin (or poison) as a by-product and cause food intoxication. Staphylococcal infected foods cause intoxication in intestine or gut through itself produced by-product (toxin), but these toxins produced by the bacteria that are already setup in the foods. Sometime foodborne diseases can be serious.

Foodborne diseases cause by some combinations of symptoms such as nausea, vomiting, and diarrhoea that may be or may not be bloody [1].

**Keywords:** Foodborne Diseases; Foodborne Bacteria; Food Intoxication

### Introduction

Foodborne diseases such as diarrhoeal diseases to linked to deaths of many people mostly children all around the world. Many outbreaks and individual cases of foodborne diseases result from consuming the contaminated food from the two most common types of pathogens that is bacteria and viruses.

When some several diseases causing microorganisms contaminate food products such as milk, meat, sea foods etc. and water; they cause foodborne diseases and that is called "Food Poisoning" [1]. Foodborne infection occurs in peoples mostly that is contaminated with some several bacteria such as *E. coli*, *Staph. aureus*, *Salmonella* and *Shigella*, *Campylobacter*, *Clostridium botulinum*, *C. Perfringens*, *Listeria monocytogenes*, *Bacillus cereus*. These bacteria causes the diseases by eaten the infected food and the bacteria continues to grow in the intestines, setting up an infection which causes diseases [1,2]. Sometime the virus causes gastrointestinal diseases through contaminated food and water, as well as contaminated surface with Norovirus or Hepatitis A [3].

Food intoxication result from the consumption of poisons or toxins producing bacterial infected food, in which grow food borne disease causing bacteria. In the some several cases, toxins cause diseases, not bacteria. When some foodborne bacteria such as *Bacillus cereus* produce the by-products (toxins or poison) during metabolism reaction that are heat resistant, which mean it can't be destroyed (or kill) by cooking [1].

Some several foods are in which bacteria can grow and multiply more easily than other. Those types of foods which bacteria prefer for their multiplication that is following [1]:

- Meat
- Sea foods
- Eggs
- Pork meat
- Poultry
- Salads
- Prepared fruits
- Cooked rice
- Unpasteurized milk or post-pasteurized milk
- Canned foods
- Untreated water
- Dairy products

These foods are more likely to be infected by foodborne bacteria but other foods can also be infected or cross contaminated with them. If food safety measures are not taken during preparation, transportation, handling and storage, other foods can also contaminated with food poisonous bacteria [1]. When foodborne bacteria are naturally found in the foods and water, in the favourable condition a single bacterium cell can grow and multiply into about more than two million bacteria in just seven hours [1]. When the food temperature is between 15°C - 50°C that is called 'food danger zone', these bacteria grow rapidly on food with lots of carbohydrates or protein. Therefore, most foodborne diseases are resulted during food preparation in unsafe environment [1]. Some foodborne bacteria such as *Listeria monocytogenes* can be also grow inside the refrigerator in ready-to-eat food products at about 5°C temperature.

As per WHO, approximately two million people annually killed to resulted from the foodborne diseases and diarrhoeal diseases which cause by bacterial infected foods.

**Some common diseases cause by the pathogens:** Some information on the common foodborne bacteria and their diseases is given below.

### Hemorrhagic colitis

Hemorrhagic colitis cause by the eaten infected foods with *Escherichia coli* that belong to a family of microorganisms called coliforms. P. Kedall, *et al.* 2012, many strains of this bacteria (or microorganisms) live peacefully in the gastrointestinal tract as a normal flora, and to help in the keep growing any other more harmful microorganisms [2]. This microorganism commonly found in intestine as a normal flora. However, one of these, *Escherichia coli* O157:H7 causes a distinctive and sometime deadly disease [2]. *E. coli* can enter your body through contaminated food and water and is often involved in major foodborne outbreaks around the world.

Symptoms begin with non-bloody diarrhoea one to five days after eating and drinking the contaminated food and water or milk, and progress to bloody diarrhoea with several abdominal pain and moderate dehydration [2].

Avoid diseases cause from *E. coli* by the practicing safe food handling, cooking meat and meat products thoroughly and avoiding unpasteurized raw milk and unpasteurized juices such as fresh apple cider. Ground beef is the food most associated with *E. coli* outbreaks [4,5].

### Staphylococcal intoxication

Staphylococcal Intoxication causes by the infection of the *Staphylococcus aureus* bacteria are found on the skin and in the respiratory tract, nose and throat of the most peoples with cold and sinus infection are often carriers. *Staphylococcus* bacteria normally live in respiratory system so that is called a normal flora of the respiratory tract. However, *Staphylococcus aureus* are also found widely in untreated water, raw milk and sewage [2]. When *Staphylococcus aureus* bacteria found into warm food and multiply, they produce a toxin or poison that is called intoxication disease. You cannot detect the toxins by the taste or smell. While the bacteria itself can be killed by temperature of 49°C, but their toxin becomes heat resistant [2].

Symptoms include abdominal cramps, nausea, vomiting, severe diarrhoea, exhaustion and sometime headache and fever. Some several food is commonly involved in staphylococcal intoxication include protein foods such as ham, processed meat, tuna, chicken, potato and meat salads, and milk and milk products [1-3].

Keep food clean to prevent its contamination include wash hand with soap and water, do not prepare or serve food if you have wounds or skin infection on your hands or wrists. Keep food out of the danger zone by cooling foods immediately and heating at 60°C temperature [1].

### Salmonellosis

Salmonellosis illness causes by consumption of contaminated foods with *Salmonella* bacteria. The *Salmonella* family includes about 2500 serotypes [1]. But two types of this species of bacteria, one of them is *Salmonella enteritidis* and other of them is *Salmonella typhimurium*, which are the most common bacteria that cause the foodborne diseases and contaminate the foods. After once eaten the contaminated food with these bacteria may continue to live and grow in the intestine and set up the infection and cause illness.

P. Kendall., *et al.* 7/2012, *Salmonella* bacteria are spread throughout the indirect or direct contact with the intestine and stomach in human and animals. *Salmonella* bacteria grow at temperature between 5°C to 45°C. Its bacteria can be destroyed by cooked twice at the temperature of 70°C and don't grow at refrigerator or freezer temperature. *Salmonella* do survive in refrigeration or freezing condition however it will begin to grow again at once warmed to room temperature.

### *Salmonella* causes two kinds of illness (as per FDA, 2012) [3]

- **Salmonellosis:** Usually characterized by vomiting, diarrhoea, cramps, nausea, and fever, with symptoms lasting a couple of day. Many kinds of foods can become contaminated, from meats and eggs to fruits and vegetables, spices and nuts.
- **Enteric fever:** Includes typhoid fever and paratyphoid fever with diarrhoea or constipation, headache and drowsiness. Enteric fever usually is associated with sewage contaminated drinking water.

There are some several habits to prevent them such as cooking foods thoroughly, good hand washing, keeping raw foods separated from cooked foods, and keeping foods at correct temperatures are good ways to avoid *Salmonella* [4].

### Listeriosis

Listeriosis disease causing bacteria is *Listeria monocytogenes*. It was primarily of veterinary concern, where it was associated with abortion and encephalitis in sheep and cattle [2]. As per several result, foodborne listeriosis is not a common disease, it is one of the leading disease which can cause death. It is widely spread in environment. It's has an ability, sometime it is survive in unfavourable

conditions and live in dormant condition in environment. When it comes into contact with any host such as food products or human and animals, it starts to keep growing and multiplication. It can grow in the pH range of 4.4 to 9.6 [2]. It is salt tolerant and relatively resistant to drying, but it can easily destroy by heat [2].

### **Listeria can cause two forms of disease in humans (as per FDA, 2012) [3]:**

- One can range from mild to intense symptoms of nausea, vomiting, fever, aches and sometime diarrhoea and usually resolves itself.
- Invasive listeriosis is a more deadly form that occurs when the infection invades beyond the gut to sites like the blood or brain. This can cause blood infection, meningitis infection around the brain and other potentially fatal problems. In pregnant women, *Listeria* infection can cause miscarriage, stillbirth, preterm labour and so many several diseases or death in newborn.

Preventive measures for listeriosis include maintaining good hygiene and sanitation, turning over refrigerated ready-to-eat foods quickly, to use pasteurized milk, avoiding post-pasteurization contamination, good hand washing, good manufacture practice for processed foods, keep refrigerator clean and at the temperature 5°C, separate raw foods from cooked foods [2,3].

### **Clostridium foodborne illness**

*Clostridium* Foodborne disease cause by the *Clostridium* species it's have two major causative agents such as *Clostridium botulinum* and *Clostridium perfringens*. In which, *Clostridium perfringens* cause clostridial food poisoning, pigbel syndrome, and *Clostridium botulinum* (type A, B, E and rarely F) cause botulism [1]. It is spores forming bacteria and its spores widely found in soil, non-potable water, domestic ponds, unprocessed foods and the intestinal tract of animals [2]. *Clostridium* species frequently contaminates Meat and meat products with their spores. Once the spores have germinated in warm, moist, protein rich environment with little or non- oxygen environmental condition is necessary for growth [2]. However, *Clostridium botulinum* bacteria mostly found in canned foods with a low acid content, unprocessed meat, and fermented fish [1].

Symptoms of *Clostridium perfringens* occur within 8 to 24 hours after contaminated food is eaten. They include abdominal pain and diarrhoea, nausea, vomiting and fever are common [2]. However, symptoms of *Clostridium botulinum* occur within 12 to 36 hours incubation period [6]. There symptoms is weakness and usually followed by blurred vision, dry mouth, drooping eyelids, and difficulty in swallowing and speaking (no fever and no loss of consciousness) [1].

We can use some several preventive measures such as keep hot foods hot and cold foods cold. Once food is cooked, it should be held hot at an internal temperature of 60C or above, otherwise, discard all perishable foods left at room temperature longer than two hours, and do not use damaged canned foods or canned foods showing signs of swelling, leakage, punctures, extensive deep rusting or crushing or denting [1].

### **Campylobacteriosis**

*Campylobacter* infections are most common in human. Campylobacteriosis or *Campylobacter enteritis* is caused by consuming contaminated food or water with the bacteria *Campylobacter jejuni* [2]. This bacterium is commonly found in the intestinal tract of healthy animals (especially chickens) and in untreated ground water. Raw and semi-boiled or half boiled cooked foods from animal origin and untreated water are the most common sources of human infection [2]. The *Campylobacter* grow in less oxygen environment. But it is easily killed by heat at 49°C temperature and inhibited by acid, salt and drying condition. It will not grow or multiply at temperature below 29°C [3].

Diarrhoea (with blood) is frequently and fever, headache, muscle pain, nausea, abdominal pain, vomiting are common symptom [1]. Symptoms usually appear within 2 to 5 days after consumption of contaminated foods and water but it can take a week with such complications as urinary tract and reactive arthritis. Meningitis, recurrent colitis, acute cholecystitis and guillain-barre syndrome are rare complications [2]. Death is also rare, have been reported in this case but sometimes it can cause dangerous diseases in human [2].

Preventive measures for *Campylobacter* infections include pasteurizing milk; avoiding post-pasteurizing contamination, cook all foods thoroughly as campylobacter species can be killed by heat, prevent cross-contamination by using separate cutting boards when handling raw and cooked foods, don't drink raw milk and wash hands frequently [2].

Some several microorganisms isolated from Indian foods and their result given below.

Sr. No.	Sources of Sample	Parameters	Result	Reference
1.	Meat	Total Plate Count	20909.09 cfu/gm	IS 5402:2012
		<i>E. coli</i>	83.90 cfu/gm	IS 5887 (Part 1):1976
		<i>Steph. aureus</i>	236.37 cfu/gm	IS 5887 (Part 2):1976
		<i>Salmonella</i>	> 10 cfu/gm	IS 5887 (Part 3):1999
		<i>Coliform</i>	69.91 cfu/gm	IS 5401 (Part 1):2012
		Yeast and Mould	86.36 cfu/gm	IS 5403:1999
2.	Pasteurized Milk	Total Plate Count	14090.91 cfu/ml	IS 5402:2012
		<i>Coliform</i>	> 10 cfu/ml	IS 5401 (Part 1):2012
		Yeast and Mould	63.64 cfu/ml	IS 5403:1999
		<i>salmonella</i>	Absent cuf/ml	IS 5887 (Part 3):1999
		<i>Steph. aureus</i>	> 10 cfu/ml	IS 5887 (Part 2):1976
		<i>E. coli</i>	> 10 cfu/ml	IS 5887 (Part1):1976
		<i>L. monocytogenes</i>	Absent cfu/ml	IS 14988 (part 1):2001
3.	Tomato sauce	Total Plate Count	1954.55 cfu/gm	IS 5402:2012
		<i>Coliform</i>	72.73 cfu/gm	IS 5401 (Part 1):2012
		Yeast and Mould	90.91 cfu/gm	IS 5403:1999
4.	Garam masala	Total Plate Count	12272.73 cfu/gm	IS 5402:2012
		<i>Coliform</i>	109.10 cfu/gm	IS 5401 (Part 1):2012
		Yeast and Mould	96.36 cfu/gm	IS 5403:1999
		<i>Salmonella</i>	Absent cfu/gm	IS 5887 (Part 3):1999
5.	Fish	Total Plate Count	34090.91 cfu/gm	IS 5402:2012
		<i>Coliform</i>	113.63 cfu/gm	IS 5401 (Part 1):2012
		Yeast and Mould	131.81 cfu/gm	IS 5403:1999
6.	Infant food	Total Plate Count	1272.73 cfu/gm	IS 5402:2012
		<i>Coliform</i>	25 cfu/gm	IS 5401 (Part 1):2012
		Yeast and Mould	12 cfu/gm	IS 5403:1999

**Table 1**

Based on BIS.

Based on testing done by Amit Kumar and Manendra Kumar, 2018 as per fssai, APEDA, BIS and NABL [4-7].

Several testing for ground water.

Sr. No.	Sample taken from (area)	Parameter	Result	Reference
1.	Phaltan, MH. India	TVC	670 cfu/ml	IS 5402:2012
		<i>Coliform</i>	> 10 cfu/100ml	IS15185:2016
		<i>Salmonella</i>	> 10 cfu/250ml	IS 15187:2016
2.	Ghaziabad UP. India	TVC	983 cfu/ml	IS 5402:2012
		<i>Coliform</i>	18 cfu/100ml	IS15185:2016
		<i>Salmonella</i>	> 10 cfu/250ml	IS 15187:2016
3.	Shamli UP. India	TVC	846 cfu/ml	IS 5402:2012
		<i>Coliform</i>	> 10 cfu/100ml	IS15185:2016
		<i>Salmonella</i>	> 10 cfu/250ml	IS 15187:2016

**Table 2**

Based on BIS

Based on testing done by Amit Kumar and Manendra Kumar, 2018 as per fssai, APEDA, BIS and NABL [4-7].

## Conclusion

Through the several studies and research on the food borne diseases, there are limited effective measures to reduce them. Mostly foodborne diseases cause by the miss- handling of the foods in India. Food safety should be considered as an integral part of the primary health care delivery system. In the India, is a need to make policy to design preventive strategies more flexible for good manufacture practice and should to prevent both ongoing transmissions of diseases and similar outbreak in the future, to continue the monitoring of foodborne diseases and collect the data of foodborne pathogens for to prevent to diseases.

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Volume 15 Issue 8 August 2019

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