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# **Overview of Food Contaminants and Adulterants and their Effects on Human Health**

**FSSAI Exam**



**FOR FSSAI EXAM**

# Overview of Food Contaminants and Adulterants and their Effects on Human Health

Principles and Basics of Food Chemistry and their Role in Human Nutrition

## For FSSAI Exam

### Introduction

- While food contains all the nutrients that the body requires and benefits from it can also be a carrier of substances and microorganisms (living or otherwise) which cause harm to the body.
- Foods that we need for our sustenance and growth, also provide material for the sustenance and growth of a host of microorganisms.
- Some of these microorganisms can cause a great deal of harm to the human body. Therefore, it is imperative that through **all the stages of producing, handling, storage, preparation and serving, food is kept safe from such contamination.**
- In this unit we will talk about **the types of contamination and how to protect our foods from them.**
- We will also discuss the problem of **accidental or deliberate addition of undesirable material to food. This is called adulteration.**

### Food Contamination

- Contamination: It is the **presence of harmful, or objectionable foreign substances in food such as chemicals, micro-organisms, dilutants before/during or after processing or storage.**
- Food can get contaminated by the water used for washing and cooking, by the soil in which it is grown, by the containers used for storage, preparation and serving and by the personnel handling the food at various stages, particularly at the stage of dishing it out and serving.

Food	Contaminant	Health Hazard
Rice and other food grains	Extraneous materials (sand, stones, gravel, and other filth)	Can cause physical damage to teeth and gums; causes vomiting, nausea, and diarrhoea, if swallowed

Turmeric, yellow dals, and pulses	Metanil Yellow (a non-permitted yellow food colour)	It is toxic to the brain and spinal cord; long-term exposure can cause liver cancer
Green vegetables	Malachite Green (green coloured dye)	It is injurious to the liver; long-term exposure can cause lung cancer
Mustard seeds/oil and other edible oils	Argemone (prickly poppy) seeds, argemone oil, and mineral oil	Can cause epidemic dropsy (swelling of the legs) and severe glaucoma (disease of the eye due to increased pressure)
<i>Paneer, khoya</i> , milk, and milk products	Starch	Decreases the nutritional value of food; long-term consumption can cause pancreatic cancer
Ice cream	Washing powder	Severe abdominal pain and abnormal liver function
Black pepper	Papaya seeds	Stomach irritation and liver damage
Tea leaves/powder	Exhausted tea leaves	Liver cirrhosis: long-term use can cause cancer
Coffee powder	Chicory powder	Diarrhoea, stomach irritation, vomiting, dizziness, and severe joint pains

- Food contaminants can be of two distinct types –
  - ✓ Chemical contaminants
  - ✓ Microbial contamination
  - ✓ Physical Contamination
  - ✓ Allergenic Contamination

## Types of Food Contamination

### Microbial Contamination

- Microbial contamination, also known as biological, is the most common cause of food poisoning.
- It is basically the existence of harmful pathogens in **food, like microorganisms, bacteria, viruses, mould, fungi, and toxins.**
- There are six types of microorganisms that can cause food-borne illness: **bacteria, viruses, parasites, protozoa, fungi, and prions.**
- This is the leading cause of food-borne **illness and food poisoning, and food spoilage or waste is the most common cause of it.**
- Chilling food causes the pathogens to become dormant but does not necessarily prevent the growth of bacteria.
- To ensure bacteria are destroyed during the cooking process, foods should be cooked thoroughly to the right temperature. However, it is noted that many microbial toxins are heat resistant and spoiled food should not be cooked and consumed.
- The most common food-borne illnesses include norovirus, salmonella, listeria, E.coli, and campylobacter, and symptoms can range from mild gastro issues to fatal and long-term diseases.
- Certain microorganisms contaminate food and cause disease in individuals who consume this food i.e., they cause food poisoning.
- **Food poisoning**, in other words, is the term used to refer to the harmful effects of consuming food contaminated by microorganisms. Food poisoning is classified into two categories:
  - ✓ Food infections.
  - ✓ Food intoxications.
- **Food infections** generally involve microorganisms present in the food at the time it is consumed. Once inside the human being they begin to grow and cause disease. Diseases like cholera, dysentery, typhoid are examples of infectious diseases caused by eating contaminated food. Several viral infections also may be contracted by man through contaminated food that has not been processed or handled adequately. These are infectious hepatitis, poliomyelitis, and various respiratory and intestinal disorders.
- **Food intoxications** involve toxic substances produced in the food by microorganisms before it is consumed.

- ✓ When such food is eaten the person becomes sick because of the toxin.
- ✓ Staphylococcus aureus and Clostridium botulinum cause bacterial food poisoning because of the toxins they give rise to in the food. Poisons produced by staphylococci cause severe nausea, vomiting and abdominal pain.
- ✓ The toxin produced by Clostridium botulinum can kill.
- ✓ It causes dizziness, difficulty in swallowing, speaking, and breathing and finally paralyzes the neck, arm, and leg muscles as well as the respiratory system.
- ✓ Certain moulds also produce toxins in the food they attack.
- ✓ These toxins are called mycotoxins. The ones commonly known are the aflatoxins found in peanuts and sometimes maize, wheat, rice, sorghum and soyabeans as well, which have been attacked by a particular mould.
- ✓ They cause liver diseases among those who consume such infected foods. The ergot fungus is associated with bajra, wheat, jowar and rye.
- ✓ This fungus produces toxins which result in ergotism. The toxin causes - - gastrointestinal disturbances, painful cramps in the legs, gangrene in fingers and toes, depression, weakness, and convulsions.
- ✓ Gangrene is a condition where body parts begin to get destroyed due to infection. Such parts often must be cut off otherwise it can spread to other parts of the body.

<b>Selected Microbial Contaminant</b>	<b>Commonly associated Foods</b>	<b>Health impacts (symptoms)</b>
Clostridium perfringens	Raw meats, poultry, fish, stews, cooked turkey and beef, casseroles, gravy dressings, food that sits for extended periods and dried foods such as spices and vegetables	Perfringens food poisoning (Intense abdominal cramps, watery diarrhea)
Staphylococcus aureus	The red meats, especially ham, poultry, potato, macaroni and tuna salads, custard and cream filled bakery product, the sandwich sauces	Staphylococcal food poisoning (Sudden onset of severe nausea and vomiting. Abdominal cramps. Diarrhea and fever may be present.)
Clostridium botulinum	Vegetables, improperly or home-canned or bottled foods, including canned meats, corn	Botulism (Vomiting, diarrhea, blurred vision, double vision, difficulty in swallowing, muscle weakness. Can

	beef, canned fish, smoked fish and vegetables, honey, mushroom, improperly processed peppers, asparagus, soup, spinach.	result in respiratory failure and death)
Listeria monocytogenes	Dairy (soft cheeses and coleslaw), meat products (pate, sausages and gas-packed delicassen goods), cold-smoked and gravid rainbow trout products, sliced cold cuts, soft cheese, butter, ice-cream and coleslawraw vegetables, fermented raw-meat sausages, raw and cooked poultry, raw meats (all types), and raw and smoked fish	Listeriosis (Fever, muscle aches, and nausea or diarrhea. Pregnant women may have mild flu-like illness, and infection can lead to premature delivery or stillbirth. The elderly or immune-compromised patients may develop bacteremia or meningitis.)
Escherichia coli O157:H7	ground beef, raw milk, chicken, vegetables and fruits, and any food exposed to raw fecal matter is at risk of being contaminated	Hemorrhagic colitis, Severe (often bloody) diarrhea, abdominal pain and vomiting, little or no fever. Can lead to kidney failure.)
Yersinia enterocolitis	Raw vegetables, milk produces, tofu, minced meat, raw pork from where other foods may be cross-contaminated.	Lymph node Inflammation, Appendicitis-like symptom)
Campylobacter species (C fejunii susp fejunii, C. coli, C. lari, C. fetus subsp. Fetus and C. upsaliensis).	Raw meats (beef and pork) water, unpasteurized milk, eggs, chicken, shellfish and mushroom.	Campylobacteriosis (Diarrhea, cramps, fever, and vomiting; diarrhea may be bloody)
Bacillus cereus	Meat and vegetables dishes, cereals, spices, custards, puddings and heat-treated desserts	Diarrheal: Watery diarrhea and abdominal cramps Emetic: Nausea and Vomiting
Salmonella	Raw meats, eggs, fish shellfish, poultry, Milk and dairy products, fish, shrimp, frog legs, yeast, coconut, sauces, salad dressing, cake mixes, cream-filled desserts and toppings, dried gelatine, peanut butter, cocoa, chocolate, pork. In general, beef is less often	Acute gastroenteritis, painful abdominal cramps, diarrhea that may be sometimes bloody, fever (1000 F to 1020 F), vomiting, headache and body aches

	contaminated with salmonella than poultry and pork	
Toxoplasma gondii	Raw or undercooked meat, especially pork, or wild game and water	Fever, swollen lymph nodes, especially in the neck, head ache, muscle aches and pains, sore throat: people in high group may develop brain inflammations, seizures, mental issues such as confusion and psychosis; in infected pregnant women, can lead to miscarriage, stillbirth or death soon after birth
Shigella	Salads of potato, chicken, seafood and vegetables, milk and other dairy products and meat products, especially poultry	Shigellosis or Bacillary dysentery (Abdominal cramps, fever, and diarrhea. Stools may contain blood and mucus.)
Entamoeba histolytica	Tap water, ice cream, ice cubes, shellfish, eggs, salad, raw or undercooked meat, peeled fruits, sauces	Amoebiasis; loose stool that may be bloody sometimes, stomach pain, fatigue, excessive gas, rectal pain, amoebic dysentery including high fever, severe abdominal pain and 10 or more episodes of diarrhea daily. Can extent to the liver, causing enlarged liver and unintentional weight loss
Vibrio vulnificus	Undercooked or raw seafood, such as shellfish (Especially oysters)	Vomiting, diarrhea, abdominal pain, blood-borne infection. Fever, bleeding within the skin, ulcers requiring surgical removal. Can be fatal to persons with liver disease or weakened immune systems.)
Hepatitis A	Raw produce, contaminated drinking water, uncooked foods and cooked foods that are not reheated after contact with an infected food handler; shellfish from contaminated waters	Hepatitis (Diarrhea, dark urine, jaundice, and flu-like symptoms, i.e., fever, headache, nausea, and abdominal pain)
Noroviruses	Raw produce, contaminated drinking water,	Viral gastroenteritis, acute non- bacterial gastroenteritis,



	uncooked foods and cooked foods that are not reheated after contact with an infected food handler; shellfish from contaminated waters	food poisoning or food infection (Nausea, vomiting, abdominal cramping, diarrhea, fever, headache. Diarrhea is more prevalent in adults, vomiting more common in children)
Cryptosporidium	Uncooked food or food contaminated by an ill food handler after cooking, contaminated drinking water	Intestinal cryptosporidiosis (Diarrhea (usually watery), stomach cramps, upset stomach, slight fever)
Cyclospora cayetanensis	Various types of fresh produce (imported berries, lettuce, basil)	Various types of fresh produce (imported berries, lettuce, basil)

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