

Food Safety Issues Relating to Fruits, Vegetables and Cereal products By

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• Food safety

Assurance that food will not cause harm to the consumer when it is prepared and/ or eaten according to its intended use.

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- Why is the concern regarding food safety arising ?
- Need to provide consumer guarantee on the safety attributes of the product to be consumed.
- Gaining market access and market confidence regarding the safety of the products exported



• HAZARD:

a biological, chemical or physical agent, in, or condition of, food with the potential to cause an adverse health effect.

• **RISK**:

The probability of a hazard occurring.



Rising awareness on food safety aspects and food borne diseases

• Worldwide:

- 840 million people do not have access to quality food.
- Around 70% of the cases are caused by biological contamination



• In industrialized countries

up to 30% of people suffer from food-borne illnesses every year

• In developing countries

It has been estimated that annually over 1,500 million children under the age of five years suffer from diarrhea and over 3 million die as a result (WHO, 1999).



Food safety issues (biotoxins, food allergens, microbiological contaminants, banned and toxic ingredients, animal feed residues, plant production residues, industrial residues)



BORNE DISEASES OUTBREAKS IN USA BY TYPE OFFOOD 1995-1999.Food affected







USA: 1990-1997 : 6 % of food outbreaks were associated to FFV USA: 1990-1997 : 6 % of food

outbreaks were associated to FFV

USA: 1973-1979 2% of food outbreaks were associated to FFV (Fresh Fruits and Vegetables)







Categorization of Safety Issues in Foods

- Biological Hazards
- Chemical Hazards
- Physical Hazards



- **Biological hazards** are microorganisms that cause foodborne illness.
- Some fungi are able to produce toxins and also are included in this group of hazards



- Chemical hazards include agricultural chemicals used in the production of fruits and vegetables insecticides, fungicides, miticides, growth regulators and sometimes fertilizers.
- Heavy metals are considered chemical hazards, too. They can be found in contaminated sewage sludge—the basis of some organic fertilizers, contaminated soils and tainted water.
- Chemicals used in cleaning and sanitizing also can be chemical hazards, if used incorrectly



- **Physical hazards** are foreign material in the product that can cause injury.
- These physical hazards can cause injury or be a carrier of microorganisms



Biological Hazards



- Microorganisms associated with fruits and vegetables include:
 - Bacteria : Salmonella, Shigella, Escherichia coli (pathogenic), Listeria monocytogenes, Clostridium species, Bacillus cereus, Staphylococcus aureus
 - Parasites: Cryptosporidium, Giardia, Entamoeba, Toxoplasma, Sarcocystis, Isospora
 - Viruses: Hepatitis A, Norwalk virus and Norwalk-like virus, Rotaviruses, astroviruses, enteroviruses, , coxsackie viruses), parvoviruses, adenoviruses and coronaviruses



- Microorganisms able to cause human disease may be found on raw produce as incidental contaminants from the soil, dust and surroundings
- Can be introduced onto the food through poor production and handling practices such as the application of untreated manure, the use of contaminated irrigation water or unsanitary handling practices.



- The surface of fruits and vegetables can be contaminated with microorganisms due to contact with:
 - soil
 - water
 - manure
 - sewage fluids
 - air
 - humans
 - animals



- Freshly harvested grains contain a few thousand to millions of bacteria per gram and from none to several hundred thousand mold spores. Bacteria are mostly in the families Pseudomonadaceae, Micrococcaceae, Lactobacillaceae, and Bacillaceae.
- Mycotoxins produced by moulds pose the most important health risk in cereals, some of them being so resistant that they cannot be eliminated during food processing



• At high moisture levels during storage of grains and flours, the microorganisms grow and alter the properties of the product.

• A wet mash of grains is likely to suffer acid fermentation due to the action of lactic and coliform bacteria. This may be followed by an alcoholic fermentation by yeast and finally, moulds.



Chemical Hazards



Chemical contaminants may be naturally occurring or may be added during agricultural production, post-harvest handling and other unit operations.



Naturally Occurring chemical hazards

- Mushroom toxins
- Mycotoxins (e.g. aflatoxin)
- Phytohaemagglutinin
- Alkaloids
- Allergens (e.g. weeds)



- Mycotoxins are secondary metabolites of fungi that contaminates of fruits and vegetables.
- Affected foods include peanuts, tree nuts, corn, cereals, soybeans, dried fruits and spices
- The fungal species of *Fusarium*, *Penicillium*, *Aspergillus* and *Stachybotrys* are the main producers of mycotoxins



Different types of Mycotoxins:

- Aflatoxins, Tropical foods groundnuts, figs, spices and maize.
- Ochratoxin A, Found as a contaminant of cereals and their products, fruit and spices. (Storage toxins).
- **Patulin** is found in mouldy fruits, vegetables, cereals and is destroyed by fermentation. Is carcinogenic and attacks the immune and nervous system in animals.
- **Fusarium** toxins infect the grain of cereals such as wheat and maize and affects the reproductive system in pigs. They include a range of toxins such as fumonisins, which have reportedly affected the nervous system of horses and cause cancer in rodents. They also include zearalenones, which are very stable and can survive cooking (Field Toxin).



• Moldy growth on Corn





- Prevention of Mycotoxin formation:
 - Crop Rotation
 - Crop Residue Management
 - Timely harvest and dry grain to below 18% moisture content



- Intentionally Added chemical Hazards
- Pesticides used in Fruits, Vegetables and cereal products
- Metals
- Flavors and Aroma enhancers



Pesticides

Pesticides are products intended for preventing, destroying or repelling any pests that endanger our food supply, health or comfort.



- Globally, herbicides constitute 50% of the total pesticides sale and in some countries like USA, Germany and Australia, the figure is as high as 60 -70%.
- In India, herbicides form a meager 19% of total pesticide consumption.
- Consumption increased rapidly from 4100 metric tonnes (MT) in 1988 -89 to 11,000 MT in 2001-02 and it is likely to further increase in future
- Pesticides used in India are insecticides (61%) of total pesticide consumption followed by herbicides (19%) and fungicides (17%)



- Pesticide Poisoning results from large doses absorbed through the skin, ingested orally, or inhaled through normal respiration (breathing).
- Prevention by
 - Washing reduces pesticide residues
 - Peeling or removing of outer material is more effective than washing treatments
 - Cooking is found to be most effective



 Residues of pesticides (ppm) in various portions of unwashed carrots

Portion	Cypermithrin	Diazinon	Parathion
Whole carrot	0.012 (1X)	0.016 (1X)	0.035 (1X)
Crown	0.12 (10X)	0.25 (16X)	0.82 (23X)
Peel	0.021 (1.8X)	0.039 (2.4X)	0.059 (1.7X)
Peeled carrot	nd (0X)	nd (0X)	nd (0X)

Burchat et al., 1998, Food Additives and Contaminants, 15(1):61



- Metals: The metals commonly identified as potential chemical hazards are: arsenic, antimony, cadmium, copper, lead, tin, zinc, mercury
- The source of the metal poisoning:
 - food handling equipment and
 - utensils made of inappropriate materials
- When high acid foods (pH less than 4.6) come in contact with the equipment or utensil surface corrosion occurs and the metal is released onto or in the food as a contaminant and the ultimate source of metal poisoning.
- Food or feed grains treated with mercury-containing fungicides are a potential source for transmission of the metal through both animal and cereal foods.



- Food additives: ingredients that are added to foods in a regulated amount for specific purposes eg Monosodium glutamate, Sulfites, Nicotinic acid, Vitamin A, Sodium nitrite.
- **Purpose:** Some Enhance flavor, aroma and texture, others enhance nutritional value while others reduce or prevent spoilage or the growth of pathogenic organisms.
- Some food additives, when used in excess, can cause health problems like allergic reactions in the case of individual sensitivities



• Allergens

- Food allergy is on the increase in Europe: 1-3 % of adults, 4-6 % of children show adverse reactions to a food.
- The severest food allergy is caused by peanuts.
- Anaphylactic shocks with subsequent death have been reported after ingestion of only a few milligrammes of peanut.
- The major food allergens have to be declared on the labels, not only if they are used as ingredients, but also if they are present as contaminants.



Physical hazard



Physical hazard: a hard foreign object that can cause illness or injury

- Inherent to the food or ingredient
- Contaminant during processing
- Metal, glass, wood splinters, rocks, insects, hair, and dirt are included in this category



Removal of Physical Hazards:

- Filter or sieve (meat grinder)
- Water bath (vegetables)
- Metal detector (all foods)
- Good employee practices (jewelry)
- Good sanitation and quality control programs



- Conclusion: Ensure safety of food using
 - Good Manufacturing Practices (GMP), Hazard Analysis Critical Control Points (HACCP) and Quality Standards ISO 9000.

- Appropriate processing methods
- Traceability and labels

THANK YOU