Food Toxicology

Food Toxicology is the study of nature, properties, effects and detection of toxic substances in food and their disease manifestation in human.

Toxin: Any agent capable of producing a deleterious response in a biological system.

Naturally occurring Food toxins

Protease inhibitors

- Protease inhibitors are proteinaceous compounds present in legumes, cereals and tubers.
- They cause poor food utilization and impaired growth of individuals.
- Soybeans contain an antitryptic factor, a trypsin inhibitor, which is responsible for poor digestibility of this useful legume. The beans are detoxified through series of operations such as soaking, germinating, steaming and fermenting.
- Fava beans have been responsible for disease called favism characterized by haemolytic anaemia, haemoglobinura and jaundice accompanied by high fever. This disease is attributed to an inborn metabolic disorder (deficiency of an enzyme, glucose-6-phosphate dehydrogenase in the erythrocytes.

Goitrogens

- Members of Cruciferae family contain appreciable amount of toxic substances collectively known as "glucosinolates".
- These substances when hydrolyzed by suitable enzymes yield compounds including goitrins which have goitrogenic activity.
- Goitrogens inhibit the uptake of iodine by thyroid glands resulting goiter.

Cyanogens

- Cyanogens are cyanogenic glycosides and are present in peas, beans, pulses, fruit kernels and cassava.
- They cause hydrogen cyanide poisoning.
- Toxicity from the consumption of cassava is common.
- Cyanogenic glycosides are also present in many fruit pits including apricot kernels. Toxicity may be caused by consumption of large amounts of apricot kernel pits.

Mycotoxins

- Growth of fungi in cereals and legumes when stored at high temperature and humidity produce mycotoxins.
- Example of mycotoxins in Aflatoxin, which can cause cancer, cirrhosis of liver and impaired immune function.

Lathyrogens

- Lathrogens are present in legumes especially in chick pea.
- These are derivatives of amino acids and affect metabolic activity especially neurotransmitters to brain.
- They can cause paralysis of lower limbs and sometimes cause death.

Lectins

- Lectins are glycoproteins present in large amounts in cereals and legumes and in small amounts in raw fruits and vegetables.
- It can inhibit nutrient absorption in the body.
- Ricin is an example of lectin proteins and in past used as insecticide.
- Application of heat can destroy lectin proteins

Nitrates

- Nitrates are present in some plants i.e. spinach, beet, radish etc.
- They are converted into nitrosamines due to chemical reaction and become carcinogenic

Glycoalkalides

- Glycoalkalides like α-solanine and α-chaconne are present in potatoes.
- They are natural pesticide.
- Synthesis is stimulated by light, mechanical injury, aging and potato beetle infestation.

Some common mineral elements, their sources and possible hazardous effects due to excess in diet

Element	Source	Toxic effects
Aluminium	Citrus fruits, stone fruits, cooking utensils	Gastrointestinal irritation, rickets
Arsenic	Sea foods	Nausea, vomiting, diarrhea, burning of mouth and throat, severe abdominal pains
Copper	Drinking water, cooking utensils, some permitted colors, preservatives	Hepaticolenticular degeneration (Wilson's disease)
Iron	Liver, kidney, heart, legumes, shellfish	Haemochromatosis, enlargement of liver, pigmentation of skin, diabetes mellitus, cardiac failure
Lead	Drinking water, food containers, cigarette smoking	Abdominal colic, peripheral neuropathy, anaemia
Phosphorus	Milk, dairy products, meat, poultry, grains	Erosion of jaw
Sodium	Common salt, several foods	Nausea, vomiting, in hypertension leads to oedema
Tin	Widely distributed in foods, tin cans	Vomiting
Zinc	Wheat germ, bran, oysters, drinking water	Stiffness and pains in the muscles of back and neck, loss of appetite, nausea, vomiting, diarrhea