

Food Safety



LEARNING OBJECTIVES

This chapter helps the students to get a bird's eye view of:

- The process of Food Selection and the factors governing the selection to ensure food safety.
- Methods to be adopted for food storage and the containers to be used for a safe food storage.
- Adulteration and its impact with the key adulterants in foods and simple tests to identify them.
- Causes of food contamination and food borne infections which prove hazardous to health.
- Method to prevent Food- Borne Illness.

3.1 Introduction

Food has been a basic part of our existence. The edible parts of plants and animals termed as “food” are consumed by people to satisfy their physiological, psychological and social needs. It is universally accepted that the nutritional value of food alone does not persuade people to eat but also its colour, flavour, texture, temperature and presentation which are the other contributory factors towards food consumption patterns of the people which ensure the wholesomeness of the food in terms of quality and quantity. Thus the consumer can get a food item without compromising on the deteriorative aspects like food contamination, food borne illnesses and infections.

Food safety is an assurance that food will not cause any harm to the consumer when it is prepared and eaten according to its use. The said assurance is determined by

- Whether the harmful substances present in the food have been eliminated or reduced to acceptable level.
- Whether food that has been prepared, handled or stored under controlled and sanitary conditions in conformation with practices prescribed by government regulations.

3.2 Selection of Food

Food selection is an important step in ensuring good nutrition for the family. The daily food guide helps in deciding the kinds and amount of foods

to be purchased. Selection of foods from the available variety is an important aspect of marketing. Intelligent selection of foods is based on the knowledge of attributes of high quality foods.

The types of food selection depend on:

- Availability of funds/ money
- Nutritional needs
- Effect of advertisements
- Likes and Dislikes

Availability of funds / Money

Money enhances the purchasing power and increases purchasing choices. People who have a lot of money can afford a variety of meals and can eat away from home. However, people with small incomes have a limited choice and it becomes a hard task to buy enough food to meet family needs.

Nutritional needs

Food choice will also depend on nutritional needs. Without food one becomes weak and ill. The nutritional needs of the people may vary based on age, activity, health condition, gender and specific needs during specific stage of growth and development. eg. Pregnancy, lactation.

Effects of Advertisements

Another great influence on food choice is advertisement. Advertisements have a way of persuading people to make choices. Food manufacturers and shops advertise their products through television, radio, magazines, newspapers, posters and leaflets. People tend to taste new food products that are endorsed by famous personalities.

Likes and dislikes

The choice of foods is often based on the likes and dislikes of the family members. Several factors contribute to our likes and dislikes such as colour, flavour, appearance and texture of the food.

In addition food selection also depends on the safety and hygiene aspects and it should be free from insecticides, chemical toxins, physical hazards and microbial contamination.

3.3 Storage of Foods

Foods can be classified as perishable, semi-perishable and nonperishable and these factors determine the methods of storage. Most food materials need to be stored for different lengths of time and at different temperatures, to preserve their wholesomeness till required for preparation and service. For effective storage of food items two types of storages are used :the dry storage rooms meant for non-perishable commodities like cereals and their products, pulses, legumes, sugar and spices, canned foods, fats and oils, etc., and the low temperature storages for semi-perishable and perishable foods.



Dry storage

It is a place for storage of dry ingredients and it should be cool, well ventilated and free from infestation. The average temperature of a dry store varies between 20°C – 25°C. It is suitable for non-perishable and semi perishable commodities.

Low Temperature Storage

The main aim of low temperature storages is to maintain the temperatures at levels which will inhibit the growth of microorganisms thereby preserving the food. Three distinct types of low temperature storage include

- a) Refrigerated Storage
- b) Cold Storage
- c) Freezer Storage for the storage of semi perishable and perishable foods.



Refrigerated Storage: It is storage space planned and maintained at a temperature between 0°C - 10°C. They are necessary to maintain the quality of perishable foods for 3-5 days only. Foods should be kept covered in refrigerated storage to prevent drying and odours been taken up by other foods.

Cold Storage: Here the temperature is maintained between 0°C and -5°C thereby reducing the enzyme activity to the minimum. Such storages are called “chill rooms” and can hold perishables for over a week and in the case of vegetables and fruits even up to a month.



Freezer Storage: The temperature ranges between -20°C to 0°C. For successful freezing the foods should be blanched, cooled quickly to freezing temperature and packed in airtight containers or bags.



ACTIVITY - 1

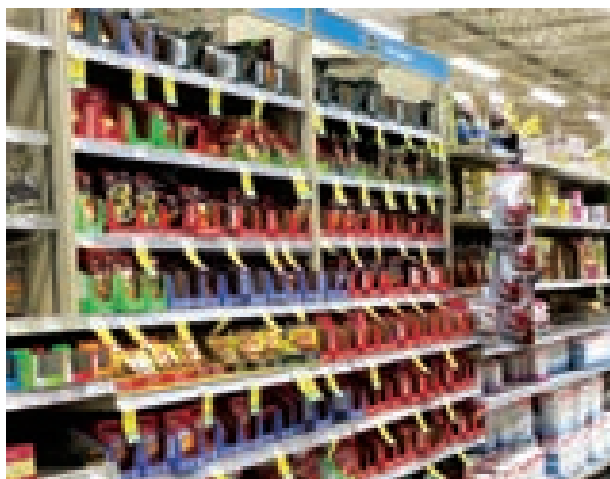
Try storing greens, brinjal, onion and egg at different temperatures in the refrigerator and see the effect

General Procedure for storage

- i. Arrange food according to the type of commodity.
- ii. Place stock item in alphabetical order of food.
- iii. Stamp the date of delivery on every stock received before shelving to ensure that the old stocks are used up first.
- iv. Place items on shelves according to date stamped, with earlier ones in the front of a row, and later ones at the back. Stamping also helps to cost the stocks more accurately according to the prices paid on the bill for the particular lot.
- v. Arrange products to give an organized appearance. Efforts should be made to ensure that commodities do not lie around on the floor at any time.
- vi. Heavy bins or drums should also be placed on wheels or on slatted platform, for free circulation of air around the food packs.
- vii. All items delivered in bulk bags of jute or poly bags like sugar, flour, cereals, pulses, etc., should be cross stacked.
- viii. Any opened bags should be immediately emptied into metal or plastic bins, polyethylene drums or cans with tight fitting lids.
- ix. Cross stacking helps free air circulation. Polythene bags of milk powder should preferably be refrigerated.
- x. Cartons of canned foods, biscuits, etc., should be stacked with their labels visible for identification.
- xi. Tins or small cardboard packs are generally used for dried fruits, preserves, mixes, jellies, etc., and may be lined up one in front of the other, each row having packs of the same item.
- xii. As a rule, vegetables and fruits require to be stored in areas separate from the main dry stores, especially root vegetables.

- xiii. Oils and fats need special attention in storage because they tend to get rancid in the presence of light. So fats and oils should be stored in a place where it can be protected from sunlight.

If foods are not stored properly they can become contaminated leading to several health hazards.



3.4 Food Adulteration

Adulteration of food stuffs is commonly practised in India by the traders. When the price of food production is higher than the price which the consumer is prepared to pay, the seller is compelled to supply a food product of inferior quality. Thus, adulteration occurs.

Definition: Adulteration is defined as the process by which the quality or the nature of a given substance is reduced through i) addition of a foreign or an inferior substance and the ii) removal of a vital element.

Adulterants can be of two types

- 1) Intentional Adulterants:** Some manufacturers mix adulterants like brick powder, chalk powder, dried seeds, stones, marble, addition of harmful colors to food items like spices, pulses (metanil yellow in Turmeric or Carmoisine in Chili powder) with intention to make more profit.
- 2) Incidental Adulterants** is the contamination due to carelessness and lack of proper hygiene during overall processing of food. It includes contamination due to defective packaging and storage and may result in bacterial or fungal attack.

As adulteration is rampant everywhere, consumer should be aware of adulterators and one should take steps to safeguard themselves against those food items. It is as shown in the table 3.4.1.



3.4.1 Common Adulterants in food and their Harmful effects

| Sl. No. | Name of the food article | Adulterant | Simple method to detect the adulterant | Harmful Effects |
|---------|--------------------------|--|---|------------------------|
| 1. | Ghee or butter | Vanaspathi | Take one teaspoonful of ghee or butter with equal quantity of concentrated hydrochloric acid in a test tube and add a pinch of cane sugar to it . Shake well for one minute and test it after 5 minutes. Appearance of crimson color shows the presence of vanaspathi | _____ |
| 2. | Milk | Water | Lactometer reading should not be less than 1.026 | Stomach disorder |
| | | | Drop of pure milk flows slowly leaving a white trail behind whereas adulterated milk with water will flow immediately. | _____ |
| 3. | Khoa | Starch | Add tincture of iodine. Blue color shows the presence of starch. | Less - nutritive value |
| 4. | Dhals | Kesari dhal | Add 50 ml of dilute hydrochloric acid to the dhal and simmer it for 15 minutes. Pink color shows the presence of kesari dhal. | Stomach pain, ulcer |
| 5. | Hing | Soap stone or other earthy matter | Shake with water , soap stone or earthy matter will settle down. | Dysentery |
| 6. | Tea leaves | Exhausted tea or black or Bengal gram dhal husk with color | Tea leaves sprinkled on wet filter paper would immediately release added color. | Liver Disorder |
| 7. | Sugar | Chalk Powder | Dissolve in a glass of water, chalk will settle down at the bottom | Stomach – Disorder |
| 8. | Chilli powder | Stones Brick Powder, Sawdust | Any grittiness present may be felt by tapping. The sediment at the bottom of glass confirms the presence of brick powder or sand. | Stomach problems |

| Sl. No. | Name of the food article | Adulterant | Simple method to detect the adulterant | Harmful Effects |
|---------|--------------------------|------------------------|--|----------------------------|
| 9. | Rawa | Iron filings | By moving a magnet through it iron filings may be separated. | — |
| 10. | Mustard seeds | Argemone seeds | Argemone seeds which are grainy with a rough surface can be separated from mustard seeds which have a smooth surface by close examination. | Epidemic dropsy & Glaucoma |
| 11. | Honey | Molasses | A cotton wick dipped in pure honey when lighted with a match stick burns. If adulterated the presence of water will not allow the honey to burn. | Stomach disorder |
| 12. | Cinnamon | Cassia Bark | Cinnamon barks are very thin and cassia barks are thick and stiff. | — |
| 13. | Coffee | Chicory | When coffee powder is sprinkled on the water surface in a glass coffee floats but chicory sinks down. | Diarrhoea |
| 14. | Black Pepper | Papaya seeds | Papaya seeds give a repulsive flavour distinct from the bite of black pepper | Stomach, liver problems |
| 15. | Rice | Marble or other stones | Place a small quantity of rice on the palm of the hand and immerse the same in water. Stone chips will sink. | — |



ACTIVITY - 2

Collect the samples of black pepper, cinnamon, chilli powder and milk and assess their quality.



The Prevention of **Food Adulteration Act, 1954** aims at making provisions for the prevention of **adulteration of food**. The **Act** extends to the whole of India and came into force on 1st June 1955.



3.5 Food Hygiene

Food Hygiene is the action taken to ensure that food is handled, stored, prepared and served in such a way, and under such conditions, as to prevent – as far as possible – the contamination of food. Good food hygiene is essential to ensure that the food prepared/sold by businesses is safe. Food safety and hygiene are important both to safeguard consumer health and the reputation of food businesses.



3.5.1 Contamination of Food

Food contamination occurs by substances (contaminants) not intentionally added to food. Contaminants are the factors responsible for unhygienic food. They compromise food safety and cause harm to the health of a consumer. Such substances may be chemical, physical or biological.

Chemical

(For example, chemical poisons like insecticide) Chemical poisons such as insecticides get into food, and toxic metals may enter food during processing. Poisonous plants (and fungi) like some types of mushrooms and seafood produce chemicals or toxins which can cause illnesses if consumed incorrectly.

Physical

(For example, undesirable substances in food) Reports of 'foreign bodies' such as dead rats, insects and pieces of glass in food get wide publicity although they are rare events. Physical contaminants such as these are usually detected by the consumer and the food is not consumed. However, substances like glass or staple pins used for packing can be dangerous. These incidents rarely cause food poisoning but are, of course, highly undesirable.

Biological

(For example, bacteria, their toxins and viruses) Biological contaminants include microorganisms/microbes which are small organisms that can only be seen through a microscope. The most common types of microorganisms are bacteria and viruses.



3.6 Food borne Diseases

Food-borne diseases, including food-borne intoxications and food-borne infections, are terms applied to illnesses acquired through consumption of contaminated food, and are also frequently referred to as food poisoning.

While many food-borne diseases may be selflimiting, some can be very serious and can lead to death particularly in children, pregnant women and older persons.

3.6.1 Classification of food-borne illnesses

- **Food-borne infections** – caused by consuming foods or liquids contaminated with bacteria, viruses, or parasites. These pathogens cause infection by:
 - Invading and multiplying in the lining of the intestines and/or other tissues
 - Invading and multiplying in the intestinal tract and releasing a toxin (bacteria only).
- **Food-borne intoxications** – caused by consuming foods or beverages already contaminated with a toxin. Sources of toxins are as follows:
 - Certain bacteria (pre-formed toxins)
 - Poisonous chemicals
 - Natural toxins found in animals, plants, and fungi.

Salmonella food Poisoning:

Causative agents: Salmonella group are the main group of bacterial agents

causing food poisoning. *S. enteritidis*, *S. typhimurium*, *S. Thompson* are the most frequent but other types have also been isolated in outbreaks of food poisoning. Salmonella food poisoning causes gastro enteritis since only the alimentary tract is involved and there is no general invasion of the body.

Signs and symptoms: The condition is characterized by nausea, vomiting, abdominal discomfort, headache and later diarrhoea. The symptoms appear 12-26 hours after the ingestion of the contaminated food. In most cases these symptoms subside in a few days and the patients recover completely in 6-8 days. Mortality rate is very low.

Foods involved: The common foods that give rise to this type of food poisoning are meat, milk, fish or eggs, the contamination being from the animal itself or from external sources. Eggs from infected

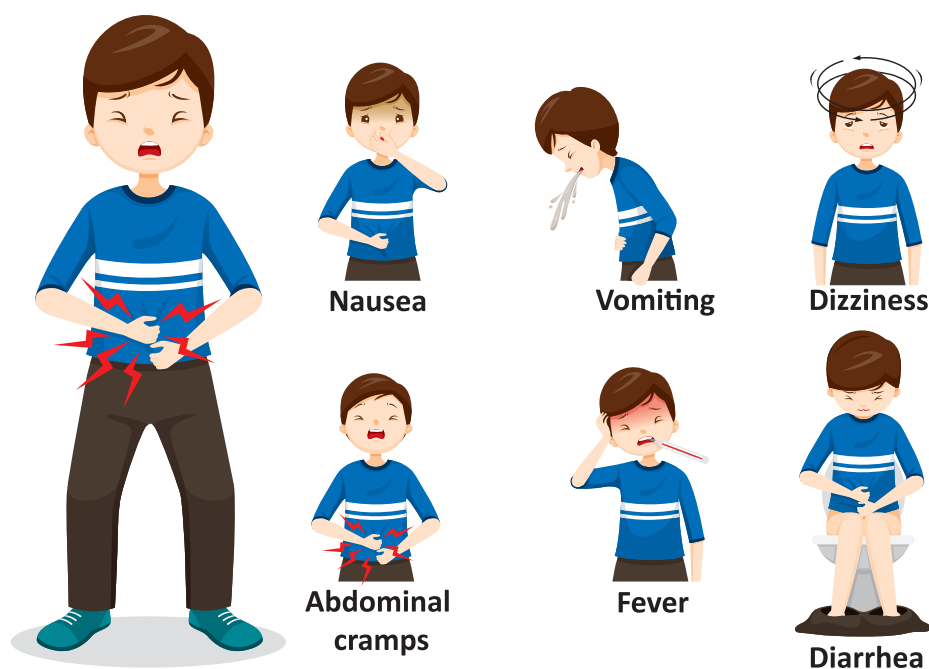
ducks have been the cause of several outbreaks, many types of *Salmonella* have been isolated from dried egg powder and egg albumen.

Staphylococcus Food Poisoning:

Causative agents: It is due to *Staphylococcus aureus* and strains of this organism produce an exotoxin which is responsible for a number of outbreaks of food poisoning characterized by vomiting and diarrhea. The sources include human or animal origin. The nasal passages of many persons contain a large number of these organisms, boils and infected wounds may also be sources of contaminating food.

Signs and Symptoms: The duration of the condition caused by staphylococcus food poisoning is only for a day or two. Mortality is extremely low.

FOOD POISONING SYMPTOMS



Foods Involved: The common foods involved are custard, cream and poultry.

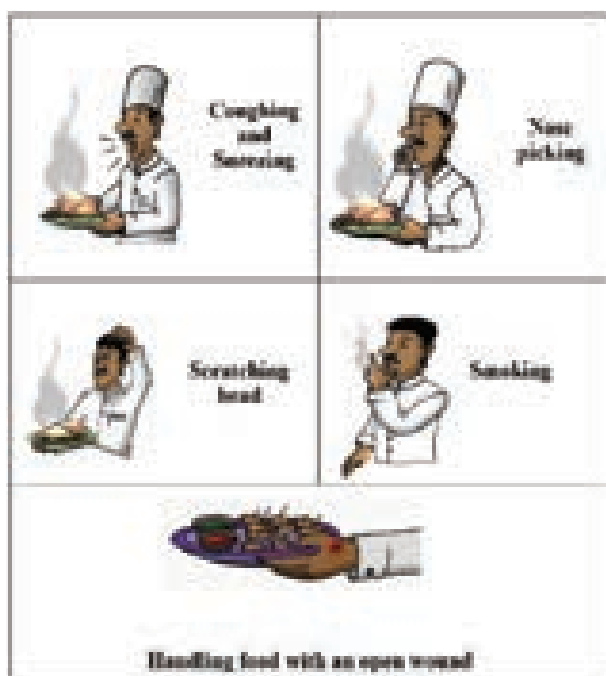
Botulism:

Causative Agent: The organism responsible for this is a spore bearing anaerobic bacillus *Clostridium botulinum* which produces an exotoxin in the food. Hence poisoning is due to the ingestion of the preformed exotoxin in the food.

Signs and symptoms: It is a toxemia and the symptoms are protrusion of the eyeballs, loss of accommodation and dilated pupils. It is most fatal and death occurs due to respiratory or cardiac failure occurs due to 4 to 8 days after the symptoms appear.

Foods Involved: It is a comparatively rare kind of food poisoning which follows the ingestion of contaminated food such as sausages, meat, fish vegetables and other canned foods.

Some ways in which Bacteria are introduced into food by food handlers



3.7 HACCP – Method to prevent Food- Borne Illness

One of the major tools for achieving a high degree of reliability and safety is called the Hazard Analysis and Critical Control Point (HACCP) system. HACCP principles apply to microbiological, chemical and physical hazards associated with foods but are mostly applied to microbiological hazards because they are the leading cause of food borne disease.

Definition: HACCP is a management system in which food safety is addressed through the analysis and control of biological, chemical, and physical hazards from raw material production, procurement and handling, to manufacturing, distribution and consumption of the finished product.

Case Study

Mary had an egg omelette yesterday and from today morning she is having nausea, vomiting and stomach ache. She consulted a doctor who said that she is suffering from food poisoning. Can you identify the causative organism?

Principles of Hazard Analysis and Critical Control Point (HACCP)

The seven steps of HACCP Process include the following:

1. **Analyse hazards** - Potential hazards associated with a food and measures to control those hazards (biological, e.g. a microbe; chemical, e.g. a toxin;

or physical, e.g. ground glass or metal fragments) are identified.

2. **Identify critical control points** - These are points in a food's production - from its raw state through processing and shipping to consumption by the consumer - at which the potential hazard can be controlled or eliminated. Examples are cooking, cooling, packaging, and metal detection.
3. **Establish preventive measures with critical limits for each control point** - For a cooked food, for example, this might include setting the minimum cooking temperature and time required to ensure the elimination of any harmful microbes.
4. **Establish procedures to monitor the critical control points** - Such procedures include determining how and who should monitor the cooking time and temperature.
5. **Establish corrective actions when monitoring shows that a critical limit has not been met** - For example, reprocessing or disposing of food if the minimum cooking temperature is not met.
6. **Establish procedures to verify that the system is working properly** - For example, testing time and temperature recording devices to verify that a cooking unit is working properly.
7. **Establish effective record keeping for documentation** - This would include records of hazards and their control methods, monitoring of safety requirements and action taken to correct potential problems.



Five Keys to Safer Food*

1. Keep Clean

- Wash your hands before handling food and often during food preparation.
- Wash your hands after going to the toilet.
- Wash and sanitize all surfaces and equipment used for food preparation.
- Protect kitchen areas and food from insects, pests and other animals.

2. Separate raw and cooked food

- Separate raw meat, poultry and seafood from other foods.
- Use separate utensils such as knives and cutting boards for handling raw foods.
- Store food in containers to avoid contact between raw and prepared foods.

3. Cook thoroughly

- Cook food thoroughly, especially meat, poultry, eggs and seafood.
- Bring foods like soups and stews to boiling to make sure that they have reached 70°C.
- Reheat cooked food thoroughly.

4. Keep food at safe temperatures

- Do not leave cooked food at room temperature for more than 2 hours.
- Refrigerate promptly all cooked and perishable food (preferably below 5°C).
- Keep cooked food piping hot (more than 60°C) prior to serving.

- Do not store food too long even in the refrigerator.
- Do not thaw frozen food at room temperature

5. Use safe water and raw materials

- Use safe water or treat it to make it safe.
- Select fresh and wholesome foods.
- Choose foods processed for safety, such as pasteurized milk.
- Wash fruits and vegetables, especially if eaten raw.
- Do not use food beyond its expiry date.



SUMMARY

- Food safety is an important issue that needs advancements in methods of maintaining the food as early as possible.
- People nowadays demand and wish to eat more hygienic, clean and healthy food. Health is always crucial to everyone.
- Offering a wholesome food in terms of quality and quantity to everyone is the first basic thing for everyone in the world.
- Preventing people from food borne disease is the most important thing that needs to be done at the earliest.
- Hence quality control of food will help people to protect them from illnesses resulting from food contamination, food infection and food poisoning.

A-Z

GLOSSARY

- Food safety (உணவு பாதுகாப்பு): A scientific discipline describing handling, preparation, and storage of food in ways that prevent food-borne illness.
- Food contamination (உணவு மாசுபாடு): presence of harmful chemicals and micro-organisms in food, which can cause illness.
- Food poisoning (விசமுற்ற உணவு): The illness resulting from eating food or drinking water containing bacteria, viruses, pesticides, or toxins.
- Adulteration (கலப்படம்) Refers to mixing of an inferior and sometimes harmful quality substances with food or drink intended to be sold.
- Food Storage (உணவு சேமிப்பு); Food storage allows food to be eaten for some time after harvest rather immediately.



EVALUATION

I. Choose the correct answer

Section A - Objective Type Questions

(1 mark)

1. Pick the odd one out
Clean, separate, cook, purchase, chill
2. Which is matched correctly
 - a. Television - Equipment store
 - b. Spare parts – Incidental adulteration
 - c. Defective - Advertisement packaging
 - d. Rava- Iron fillings
3. Cross stacking during storage helps in
 - a) Water flow
 - b) Air circulation
 - c) Easy identification
 - d) Good ventilation
4. Selection of food depends on
 - a) Likes and dislikes
 - b) Availability of money
 - c) Nutritional requirements
 - d) All of the above
5. Refrigerated storage is a type of
 - a) Dry storage
 - b) Low temperature storage
 - c) Miscellaneous storage
 - d) Trash storage
6. Biological contamination is caused by
 - a) Band- Aid
 - b) Pesticides
 - c) Plastic
 - d) Micro organisms
7. Kesari dhal is commonly adulterated with
 - a) Chilli powder
 - b) Asafoetida
 - c) Bengal gram
 - d) Coffee powder
8. Botulism is caused by the ingestion of contaminated
 - a) Custard
 - b) Cream
 - c) Egg powder
 - d) Meat
9. HACCP principles are applied to
 - a) Microbiological hazard
 - b) Biological Hazard
 - c) Pollution Hazard
 - d) None of the above
10. Starch adulteration in milk products can be identified with
 - a) Iron
 - b) Iodine
 - c) Calcium
 - d) Phosphorus
11. Blanching of food enhances
 - a) Freezer storage
 - b) Refrigerated storage
 - c) Cold storage
 - d) Chill storage
12. Food borne infections can cause
 - a) Cholera
 - b) Typhoid
 - c) Dysentery
 - d) All of the above



II. Write Very Short Answers

(2 marks)

1. What is food adulteration?
2. Define food contamination.



3. Give the harmful effects of coffee powder with excess chicory.
4. What are the signs and symptoms of staphylococcus food poisoning?
5. What is a cold storage?

III. Write Short Answers (3 marks)

1. What is meant by food safety?
2. Explain refrigerated storage?
3. What are the causes of physical contaminants?
4. What are the common adulterants in asofoetida and termeric?
5. How do advertisement influence food selection?

IV. Write in detail (5 marks)

1. Explain the general procedure for storage?
2. List the steps of HACCP.
3. What is Salmonella food poisoning?
4. What are the simple ways to detect adulteration in
a) Mustard Seeds b) Honey.
5. Describe the categories of storage.



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