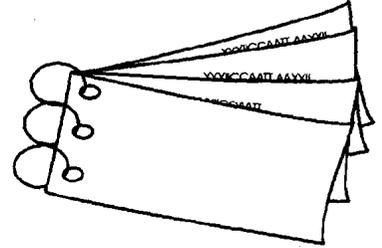


UNIT 11 FOOD ADULTERATION

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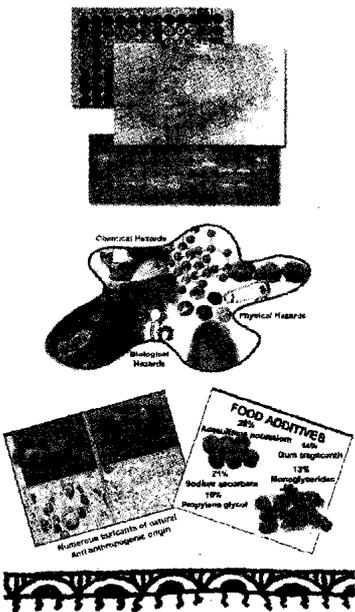
- Food adulteration takes into account not only the intentional addition or substitution or abstraction of substances which adversely affect the nature, substance and quality of foods, but also their incidental contamination during the period of growth, harvesting, storage, processing, transport and distribution.
- A food adulterant would be defined as any material which is added to food or any substance which adversely affects the nature, substance and quality of the food.
- The primary motive behind adulteration is economic gain. Profit margins are increased by using cheap substitutes, masking spoilage in foods and increasing shelf life of food by addition of preservatives.

11.1 When is Food Considered Adulterated?

Any article of food shall be considered as adulterated under the PFA Act (1954):

- (a) if the article sold by a vendor is not of the nature, substance or quality demanded by the purchaser or is not of the nature, substance or quality which it ought to be. Thus for example, if a sweets vendor leads his customers to believe that his sweets are prepared in pure desi ghee and actually he uses a mixture of hydrogenated vegetable oil and ghee, his sweets will be considered to be adulterated.
- (b) if the article contains or processing has produced in it injurious ingredients, for instance during the process of hydrogenating oil to prepare vanaspati, nickel is used as a catalyst. If not properly removed, this metal can prove to be a hazard.

- (c) if any inferior or cheaper substance has been substituted wholly or in part for the article e.g. starch powder has been mixed in milk powder.
- (d) if any constituent of the article has been wholly or in part abstracted e.g. natural flavours or essential oils have been removed from spices before selling them.
- (e) if the article has been prepared, packed or kept under unsanitary conditions or it has become contaminated or injurious to health;
- (f) if the article has any filthy, putrid, rotten, decomposed or diseased animal or vegetable substances or is insect-infected or is otherwise unfit for human consumption;
- (g) if the article is obtained from a diseased animal;
- (h) if the article contains any poisonous or other ingredient which renders it injurious to health;
- (i) if the container of the article is composed of poisonous or deleterious substances which renders its contents injurious to health. For example, harmful chemicals can leach into the food kept in containers made from poor quality plastics.
- (j) if it contains unpermitted colour or if the amounts of the prescribed colouring matter are not within the prescribed limits. For instance, only 100 ppm of colour can be added to ice cream and the colour is to be chosen from a list of eight approved by the PFA Act.
- (k) if the article contains any prohibited preservative or an excessive amount of permitted ones.
- (l) if it does not satisfy the prescribed standards laid down by the authorities and which makes the article injurious to health. For e.g. an article of food should not have more than the permitted level of pesticides. If it does, it makes the food article unsafe for consumption.
- (m) if it does not satisfy the prescribed standards laid down by the authorities but the article does not become injurious to health. For e.g. sugar should not have more than 0.5 per cent by weight of moisture. If it does, the sugar is adulterated but such an adulteration is not injurious to health.



11.2 Commonly Adulterated Foods

- Any commodity that is either expensive or sells more is a target for adulteration. Surveys on the current trends in food adulteration reveal that adulteration of milk and milk products, edible oils and fats and spices is most common.
- Foods which are in a powder, minced or paste form are also more likely to be adulterated as it is more difficult for the naked eye to detect adulteration in these foodstuffs e.g. minced mutton, red chilli powder.
- Adulteration of foods sold loose by the retailer is also more common as compared to packaged foods. In the case of foods sold loose it becomes difficult to fix the responsibility on manufacturer, distributor or retailer.

Manufacturers should discourage their products from being sold loose and their packaging should also be tamper-proof.

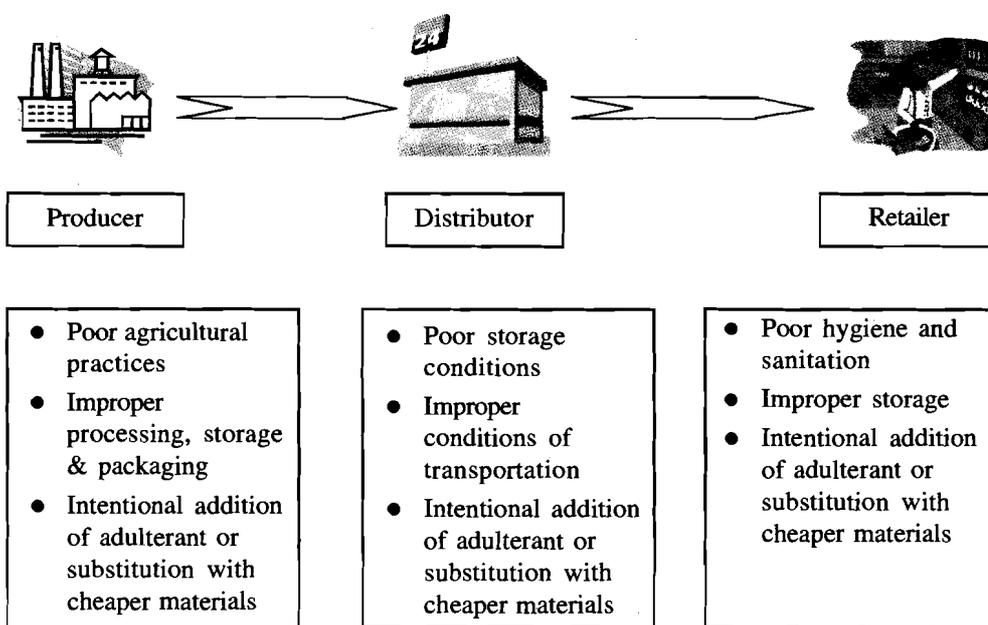
- Foods commonly adulterated include:
 - Food grains like wheat, rice, pulses and their products like wheat flour, semolina (suji), gram flour (besan) ;
 - Edible oils and fats like groundnut oil, safflower oil, sunflower oil, mustard oil, vanaspati;
 - Spices, both whole and ground, like red chilli powder, turmeric and coriander powder, asafoetida (hing), saffron;
 - Milk and milk products like milk powder, butter, ghee, khoa, sweets;
 - Coffee, tea;
 - Sweetening agents like sugar, honey, gur;
 - Non-alcoholic beverages like aerated drinks, squashes, juices, sherbets;
 - Miscellaneous items like confectionery, jams, sauces, ice creams and prepared food items like sweets (laddoo, burfi, jalebi), curries, rice preparations like biryani, tandoori meat dishes.

11.3 Stages at which Food Adulteration Occurs

There are three stages at which food gets adulterated:

1. Producer
2. Distributor
3. Retailer

We can summarize how our food can get adulterated at each stage.

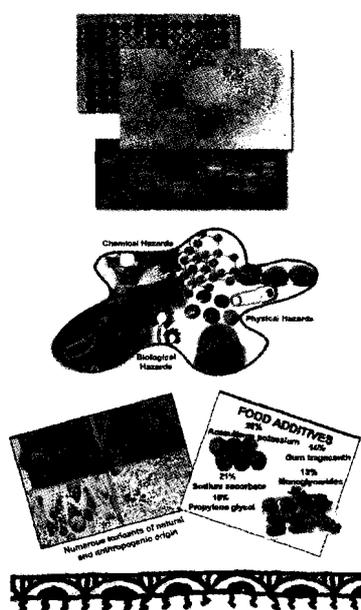


11.4 Common Adulterants

The following table gives a compilation of the types of adulterants (excluding microbial contaminants) detected in different food items.

Table 11.1: Types of adulterants detected in different food items

Food items	Adulterants detected
Milk	Antibiotic residues, formalin, boric acid, pesticide residues, neutralizers like sodium bicarbonate, urea, water, sugar, starch, foreign fat
Milk powder	Pesticide residues, sugar, starch, fat deficiency, excessive moisture
Ghee and vanaspati	Extraneous colours, animal body fat, hydrogenated vegetable oils, excessive moisture
Edible oils	Castor oil, mineral oil, argemone oil, triorthocresyl phosphate, oil soluble colours, aflatoxin, pesticide residues, cheaper vegetable oils
Spices	Non-permitted colours, mineral oil coating, husk, starch, foreign seeds/resins, extraneous matter, exhausted spices
Non alcoholic beverages	Saccharin, dulcin, brominated vegetable oils, non-permitted colours, excess permitted colour
Confectionery, sweets & savouries	Non-permitted colours, aluminium foil, permitted colour more than prescribed limit
Coffee	Chicory, date or tamarind seeds, artificial colour
Tea	Colour, iron filings, foreign leaves, exhausted leaves
Pulses and their products like <i>besan</i>	Foreign pulses like <i>Lathyrus sativus</i> , <i>Vicia sativa</i> , <i>Lens esculenta</i> , artificial colours, talc, foreign starch, extraneous matter
Cereals and their products like <i>maida</i> , <i>suji</i> , flour	Fungal infestation, pesticide residues, sand, dirt, foreign starch, powdered chalk, iron filings



Although simple forms of adulteration like addition of water to milk and coloured starch to turmeric are still prevalent, newer forms and types of adulteration are emerging such as pesticide residues, coating insect-infested dry ginger with ultramarine blue to cover holes and other damage; urea in puffed rice to improve texture; injecting colour into poor quality fruits, vegetables.

11.5 Harmful Effects of Adulterants

- There are many adulterants which might prove to be a hazard to our health especially if consumed over a long period of time.

- Details of pests, bacterial and fungal contaminants and their adverse effects have already been dealt with in earlier Units. Similarly metallic contaminants, pesticides and veterinary drug residues have already been discussed in Unit 10.
- Chemicals like urea, sodium carbonate, sodium hydroxide, formaldehyde and hydrogen peroxide added to increase shelf-life of milk can be harmful when ingested. They can damage the intestinal lining by irritating it.
- Unpermitted food additives or permitted food additives added in excess, both can cause serious damage to health. Whether they are flavourings, colourings, preservatives, antioxidants etc. they are all chemicals which are safe only if eaten in very small quantities.
- The use of certain colours has been banned as they are well known for their toxicity in experimental animals. Non-permitted colours like Auramine, Rhodamine B, Sudan Red, Malachite Green, Orange II lead to retardation of growth and affect the proper functioning of vital organs like liver, kidneys, heart, spleen, lungs, bones and the immune system. The commonly used metanil yellow could be injurious to the stomach, ileum, rectum, liver, kidney, ovary and testis. All the non-permitted colours can also bring about changes in genes, most having been identified as potential cancer-causing agents.
- Toxicity of permitted colours is also well demonstrated as allergic response to these colours e.g. tartrazine.

11.6 Impact of Adulteration on Economic Sector

- Economic losses involve value of food rendered unfit for consumption. In addition there is the cost of treating people who have fallen sick, been disabled or the heavy cost of lives lost.
- If exported foods do not meet rigorous quality standards, they would have to be recalled, cases would be filed in court and the product would lose credibility in the local and international market.

11.7 Methods for Detection of Common Adulterants

There are three types of simple tests for detecting adulterants. These are:

- Simple visual tests;
- Simple physical tests; and
- Simple chemical tests.

The following table summarizes simple visual tests.

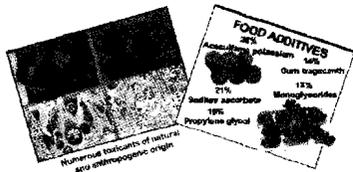
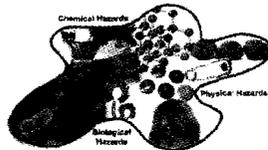
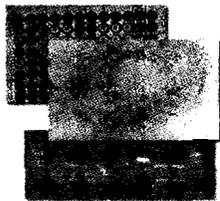
Table 11.2: Simple visual tests for detecting adulterants

Sl	Food	Adulterant	Method of detection
1	Pulses, whole and split	<i>Kesari dal</i>	<i>Kesari dal</i> is wedge shaped, with a slant on one side and a square face on the other side.
2	Mustard seeds	Argemone seeds	Argemone seeds have a rough surface with a little tail at one end. Mustard seeds are smooth. Upon pressing, mustard seeds are yellow inside while argemone seeds are white.
3	Black pepper	Papaya seeds	Papaya seeds are comparatively shrunken, oval and greenish brown to brownish black in colour.

The following table summarizes the simple physical tests.

Table 11.3: Simple physical tests for detecting adulterants

Sl	Food	Adulterant	Method of detection
1	Milk	Water	Measures the specific gravity with a lactometer by immersing it in milk kept in a deep vessel. The normal values lie between 1.028-1.032. Lower values indicate added water. But this is not a foolproof method as in addition to water, sugar or urea may have been added to the milk to increase its specific gravity.
2	Tea leaves, <i>suji</i>	Iron filings	Easily separated by passing a magnet over surface of food.
3	Honey	Sugar solution	A cotton wick dipped in pure honey burns smoothly when lighted. If water is present it will not allow the honey to burn. Even if it does, a crackling sound is produced. (The test is for water which is there in the sugar solution added as an adulterant to honey).
4	Coffee	Chicory	Sprinkle coffee powder on the surface of water in a glass. Coffee floats while chicory starts sinking leaving a trail of colour, due to a large amount of caramel.
5	Tea	Artificial colour	Put the tea leaves on a moistened blotting paper. Artificially dyed tea will impart colour to the moistened blotting paper immediately.
6	Milk	Developed acidity	Place a test tube containing 5 ml of the milk sample in a boiling water bath and hold for about 5 minutes. Remove the tube and rotate



SI	Food	Adulterant	Method of detection
			in an almost horizontal position. The film of milk on the side of the test tube is examined for any precipitated particles. Formation of clots is indicative of developed acidity in the milk due to microbial spoilage. Such milk is unsuitable for consumption.

The following table summarizes the simple chemical tests.

Table 11.4: Simple chemical tests for detecting adulterants

SI	Food	Adulterant	Method of detection
1	Milk, milk products, powdered spices	Starch	Mix sample in test tube with water, add a few drops of iodine solution. Blue colour indicates the presence of starch
2	Milk, milk powder	Neutralizers like carbonates	To about 5 ml of milk in a test tube add 5 ml of alcohol and a few drops of rosolic acid solution and mix the contents of the test tube. A rose red colour is obtained in the presence of a carbonate whereas pure milk shows only a brownish colouration.
3	Ghee, butter	Margarine or <i>vanaspati</i>	In one tea spoon-full of completely melted sample add 5 ml concentrated hydrochloric acid. Shake for 5 minutes, add a pinch of sugar or furfural. Appearance of pink colour in the acid layer indicates added <i>vanaspati</i>
4	Sweetmeats, ice cream and beverages, <i>sela</i> rice, pulses, spices	Metanil yellow	Extract colour with lukewarm water from food samples and add a few drops of concentrated hydrochloric acid. A magenta colour indicates the presence of metanil yellow.
5	Pulses, whole and split, <i>besan</i>	<i>Kesari dal</i>	Put the sample in dilute hydrochloric acid. Pink colour develops indicating the presence of <i>kesari dal</i> .
6	Silver foil	Aluminium foil	To metal foil add 2 drops of concentrated Nitric acid in a test tube. The silver foil will completely dissolve whereas the aluminium foil remains undissolved.

Key Terms

Abstraction: Removal

Acute: Severe, coming sharply to a crisis

Colic: Pain in the abdomen

Cyanosis: A bluish discolouration of the skin due to the presence of oxygen-deficient blood

Disorientation: Confusion about one's whereabouts or bearings

Exhausted spices: Spices from which essential oils and flavours have been extracted

Extraneous: Of external origin

Flatulence: Formation of gas in the gastrointestinal tract

Food-borne: Carried or transmitted by food

Immune system: Complex network of cells and cell products which protects the body from disease

Laxative effect: Increased bowel movement

Malpractice: Criminal wrongdoing or misconduct

Mycotoxin: Toxin produced by fungi

Nausea: A feeling of sickness with an inclination to vomit

Oedema: A condition characterized by an excess of watery fluid collecting in the cavities or tissues of the body

Putrid: Rotten, foul

Wholesome: That which promotes health



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