Chapter -1
Introduction

India is the world's 2nd largest producer of food next to China. With India's food production likely to increase significantly during the next decade. There has been a long debate in India and abroad regarding food quality and safety issues. According to the latest Census (2001), Uttar Pradesh (U.P) has a population of 16,60,52,859 of which men account for (52.67 per cent) 8,74,66,301 and women (47.33 per cent ) 7,85,86,558. In terms of demography U.P’s contribution to the national population works out to 16.17 percent, the state has one of India’s fastest growing populations and Varanasi is a part of this large state. Access to good quality, safe and nutritious food is considered a basic right of the people.

Consumption of unsafe, contaminated food leads to food-borne diseases which cause considerable morbidity and mortality. In India the diseases transmitted by food are commonly referred to as food poisoning and are characterized by abrupt onset of gastrointestinal disturbances viz. abdominal pain, vomiting and diarrhoea. The foods most commonly involved in food-borne disease are meat and meat products, poultry, eggs, milk and milk products, sweetmeats and rice preparations. Besides domestic consumption, more and more food is moving across international borders for a combination of social, economic and technological reasons.

1.1 Importance of food

Food is basic human need for survival. Through centuries food has been recognized as an important need for human in health and diseases. It is one of the basic requirements of man as also of all living beings. Every activity of man is aimed to procurement of food and it is only after having met with this requirement that he thinks of other less important
requirements. Food serve as source of nutrition, and supply energy to body via metabolism of carbohydrate, proteins, fats, vitamins and minerals. Thus, food regulates our body processes, protects us from diseases and satisfies our lunges which give us a sense of psychological satisfaction. In the III Chapter of Shreemad Bhagwat Geeta there is a line "Anant Bhawati Bhootanee" which means "the human being is made from food".

Therefore getting pure food is right of every human being. Pure food gives us health, happiness, efficiency and longevity. Pure food is what it is represented to be; it should be wholesome and do all the good it should do and be free from anything that does any harm or might impair its goodness. The nature, quantity and quality of food pay a vital role in the maintenance of health of individuals.

Food is usually composed of carbohydrates, fats, proteins and water that can be eaten or drunk by an animal, including humans, for nutrition or pleasure. Almost all the foods are of plant or animal origin. However water and salt (both inorganic substances) are important parts of the human diet. Salt is often eaten as a flavoring or preservative. Other foods not from animal or plant sources include various edible fungi, such as mushrooms. Fungi and ambient bacteria are used in the preparation of fermented and pickled foods such as leavened bread, alcoholic drinks, cheese, pickles, and yogurt. Many cultures eat seaweed, a protist, or blue-green algae (cyanobacteria) such as Spirulina. Additionally baking soda, another inorganic substance, is used in food preparation. Food products produced by animals include milk produced by mammals, which in many cultures is drunk or processed into dairy products such as cheese or butter. In addition birds and other animals lay eggs, which are often eaten, and bees produce honey, a popular sweetener in many cultures.

While some food can be eaten raw, many foods undergo some form of preparation for reasons of safety, palatability, or flavor. At the simplest level this may involve washing, cutting, trimming or adding other foods or ingredients, such as spices. It may also involve mixing, heating or cooling, pressure cooking, fermentation, or combination with other food. In a home, most food preparation takes place in a kitchen.
Some preparation is done to enhance the taste or aesthetic appeal; other preparation may help to preserve the food; and others may be involved in cultural identity. Therefore, a meal is made up of food which is prepared to be eaten at a specific time and place.

Preparation and processing of food products may modify their nutritional value and use of food additives may introduce direct or indirect toxicity, but the real hazards to health are caused by food adulteration. In order to curb the menace of food adulteration, Government of India had introduced the prevention of Food Adulteration Act, 1954 with prevention of Food Adulteration rules 1955. The object of this food legislation is to prevent adulteration and misbranding of foods as defined there in and punish responsible one because it is crime against humanity. The social evil of fraudulently selling adulterated food stuffs not only affects the health of the citizens but tends to demoralize the whole nation and grievously obstructs its moral & economic progress. The provisions of the act are directed for the purpose of securing purity of food and to inform purchasers of what they are buying and they must be construed to affect such purpose.

1.2. Food adulteration

1.2.1. What is adulterated food?

Adulteration was defined as being the fraudulent addition to any substance of another, for the sake of increased sale or profit. Adulteration, a term applied to the deterioration of different articles of food, drugs, etc, by mixing them with cheap and inferior substances. The oxford dictionary defines it as making some substance impure by adding any impurities or removing a vital component. It means the reduction in quality of the food substances either by addition of foreign substances. A substance added to a food-item to reduce its quality in order to increase its quantity is called as an adulterant. This act of addition of the adulterant in food-items is known as food adulteration. The addition of adulterant may be intentional or accidental. But generally the adulterant addition is intentional. The major reason for the intentional addition of these adulterants is for increasing the profit margin on the expense of the health of the public or consumer.
1.3. Food stuffs and their Adulterants

Almost all the food stuffs being sold in the market are adulterated, but main food products that are heavily adulterated such as spices, milk products, edible oil, beverages drinks, sweets, pulses, sugar, processed foods, rice and cereal products like flour, maida, sooji, etc. The mineral poisons are generally used to give light colors to confectionery, and the fine green shades to pickles and to tea, (can only be detected by chemical analysis). The white bread, in many hotels are due to addition of alums or the cheaper and less nutritious adulterants such as rice, potatoes, corn, beans, and rye, etc. Whiteness, appears due to taking out the bran a most valuable part of the grain, viz., its azotised or flesh-forming portion is lost. The baker often select the flour from which the more nutritious portion of the grain has been separated by the miller, and to make this flour still more white Some of these such as Carbonate and sulphate of lime, silicate of magnesia in the form of soapstone, white clay, carbonate of magnesia, bone dust, and bone ashes, besides their direct effect in lessening the value of the article, also causes the bread to absorb much more water, and thus add to its weight by substituting water for flour.

Tea may have old used leaves re-dried, willow leaves and twigs, and even iron filings that can be quickly detected. Sugar is mixed with inferior kinds of the same article, and the chief impurities in raw sugar may be cane fiber, accidental dirt, and the flour. Mustard is invariably adulterated with flour or argemone seed, which forms one-half or three-fourths of the article usually sold. Turmeric is often added to bring up the color after this whole-sale admixture and cayenne to give it strength.

Pepper is largely adulterated with meal or starch, gypsum, and dirt of any kind, to give bulk and weight. The starchy substance may be detected by the microscope, the earthy ones will be left as ash after burning, and their character may be ascertained by the polariscope. The particles of pepper itself are easily recognized by the characteristic stellate cells in the outer skin, and the hard angular ones of the inner part of the seed. The main foodstuff and their adulterants are given in table 3.
1.4. Causes of food adulteration

The problem of adulteration has been present in the society from ancient time. But at that time, due to small transactions and less populations, it was not very hazardous and serious. Adulteration of food is commonly practiced by traders in India. It poses a major threat to human health. These days rarely any food item is spared from the malicious practice of food adulteration. Almost every food-item from milk to fruits, from vegetables to grains is added with adulterants. Some adulterants enter via agricultural steps, as they are not cleaned well. These are visible adulterants like stones, leaves, soil, sand and dust to name a few. The consumer can clean them and this makes it less harmful. Other adulterants that are intentionally added are invisible or they are made invisible by astutely camouflaging with the color or texture. They are generally harmful for the health and most of them lead to serious health problems like cancer. Adulterant reduces the quality of the food and this weakens the health of the one who consumes them, thereby increasing the cost for healthcare. Regular intake of an adulterated food can lead to many health problems. From curable to incurable disorders and diseases can ruin one’s lifestyle and life as well.

In present time due to large scale population and demand of food products, the adulteration problem has taken a dangerous shape. Releasing the implications of the problem the government enacted and brought into force laws and rules to combat the menace.

1.5. Types of adulteration

Contaminants can be deliberately added or they can get into the food from the environment. ‘Additives’ refers to substances that are not a part of the food; they could be colourants, flavoring agents, preservatives, sweeteners and stabilizers. Many additives such as artificial colours or adulterants are added to food items in order to enhance their appearance and thereby their marketability. The addition of many non-edible substances, food additives and contaminants to foodstuffs pose a serious threat to the health of consumers.
There are several modes of accomplishing this end; the first, and the most common, is by addition of some article to increase the bulk or weight e.g. when starch is added to mustard, and cheaper flours to wheaten flour; the second by improving the appearance and apparent quality, so as to sell an inferior article at the price of a better, as in the case of the artificial coloring of pickles made of stale vegetables to resemble fresh. Common adulterants are lower grade harmful substances like the use of Argemone oil mixed in mustard oil. Other leaves and saw dusts are adulterant when they are mixed with the original tealeaves. Many toxic chemicals are also used to add color to sweets. Methanol is an adulterant for alcohol. Original ghee is adulterated with vanaspati. Honey is adulterated with other sugar. Pulses are adulterated by various colours to give them fresh look. Similar toxic coloring approaches are used for vegetables and fruits to look as fresh as they can, in order to increase their sale. One of basic food, milk is commonly adulterated with water.

1.5.1 Physical contamination

Adulteration is one of the major physical contaminations. Sand, dirt, earth, gritty matter, soap stone, common salt, coriander powder or chili powder- sawdust, rice bran (added to flour), refined flour (maida), gram flour (besan), spices, sugar, tea-dust and coffee and washing soda are generally added to table salt, Argemone seeds are mixed with mustard seeds; all are example of physical contamination. In tea-dust one can even finds iron filings. Lovely silver leaves used to decorate sweetmeats, burfi, and pan, may be aluminum leave or foil, which is very bad for health, causing a lot of physical complications are also an example of physical contamination.

1.5.2. Chemical Contamination

Chemicals, which cause a harmful reaction when consumed by animals or humans, are said to be toxic. It turns out that almost everything is a toxicant or “poison” if consumed at a high enough level. The use of chemicals in the production and processing of food and food products not only affects the quality, but also disguises the deterioration and constitutes deliberate adulteration which is potentially very harmful to the health. For example Lead chromate added in turmeric and Metanil Yellow dye added in starch based
material (used mostly to color Besan or gram flour, pulses, miscellaneous prepared foods namely sweetmeats like ladoo, burfi, jelabi, dalmoth, papad), for adding white color in bread, **ultra marine blue is added for developing** deep pink color (Gulaabi), **Rhodamin-B** is added, Melamines is often added in various painting of toys and to increase flavor of protein in infants milk all are example of chemical contaminations.

1.5.3. **Microbiological Contamination**

Microbiological contaminated food is perhaps imposes the most prevalent health problem in the contemporary world. Consuming old, used, residual, fermented, spoiled, and contaminated, toxic and bacterial infested food causes food poisoning. Infants are more susceptible to food poisoning. **Gastroenteritis** is caused by food contaminated with the **enterococcus, streptococcus faecalis**, which is frequently found in the human intestinal tract. Poisoning is caused by inadequately refrigerated food contaminated with microorganism, **Clostridium perfringens** grows in the alimentary canal producing the poisoning 8-12 hours after the ingestion of contaminated food. **Bacillus cereus**, a gram positive, aerobic, spore-forming organism has been reported to be the etiologic agent in numerous food poisoning outbreaks. Incidence of liver cancer is high in our country due to aflatoxin. Flavism is caused by eating broad beans or by inhaling, the pollen of its flower. **Flavism** is a hemolytic anemia. In severe cases death may occur within 24-48 hours of the onset of the attack. **Lathyrysm** is a disease, which paralyses the lower limbs. Its incidence is higher in males than in females. The disease is associated with consumption of Khesari dal and its besan.

1.5.4. **Metallic Contamination**

Metals are one of the many unintentionally contaminants of food. When present beyond small quantities, they become toxic. There may be various ways through which it can occur for example into food through air, water, soil, industrial pollution and other routes. Metals may enter from foods utensils also. **Enamelware** of poor quality contributes antimony and galvanized utensils zinc. A major source of tin contamination is **tin plate**, which is used for making containers for all types of processed foods. **Canned foods** if they are acidic and stored in tins, then after opening lid, change in colour or food can
develop a metallic flavour that is unpalatable. A small quantity of metal is added when
food is cooked in aluminum utensils. Copper is an essential trace element required by the
human body but copper contaminated food is toxic.

1.5.5. Other contaminants

1. Fumigants are generally used to sterilize such food where steam heating is
impractical. Ethylene oxide is a commonly used fumigant, which reacts with food
constituents to produce or destroys essential nutrients. It reacts with inorganic chloride to
form ethylene chloro hydride, which is toxic.

2. Various solvents are used for the extraction of oil from oil seeds. But solvents like
trichloro ethylene react with the foodstuff being processed with the formation of toxic
products.

3. During processing of food, their lipids can undergo numerous changes on prolonged
heating, oxidative and polymerization reactions take place, which decreases the value of
the processed products.

4. Smoking of meat and fish for preservation and flavouring is an old practice. This
processing contaminates the food with polycyclic aromatic hydrocarbons such as
benzopyrene, many of which are carcinogenic.

5. Lubricants, packing materials etc. also contaminate foods.

6. A number of chemicals are intentionally added to foods to improve their nutritional
value, maintain freshness, impact desirable properties or aid in processing. They also
contaminate food if excessive in quantity.

Table 1.1: Types of contaminations

<table>
<thead>
<tr>
<th>a. Physical contaminations:</th>
<th></th>
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<tbody>
<tr>
<td>Various dust sand and other solid additive that increases weight</td>
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<tr>
<th>b. Chemical contaminations:</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>(a) Food additives (direct and indirect) ; (b) Pesticides and herbicides (c) Veterinary drugs ; (d) Radiological hazards ; (e) Toxins of natural origin (f) Other chemical contaminants</td>
<td></td>
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</tbody>
</table>
c. *Biological contaminations:*

(a) Increased hazards from microbiological agents; (b) Growing of and use of genetically modified organisms; (c) Centralized large-scale production of food; (d) Expanded food trade; (e) Increased tourism

d. *Metallic contaminations*

Inclusion of toxic doses of metals through various utensils

e. *Other contaminations*

Various sterilants, solvents, fumigants and preservative.

1.6. **When any article is said to be adulterated**

An article of food shall be deemed to be adulterated -

- If the article sold by a vendor is not of the nature, substance or quality demanded by the purchaser or which it purports to be;
- If the article contains any substance affecting its quality or of it is so processed as to injuriously affect its nature, substance or quality;
- If any inferior or cheaper substance has been substituted wholly or partly for the article, or any constituent of the article has been wholly or partly abstracted from it, so as to affecting its quality or of it is so processed as to injuriously affect its nature, substance or quality;
- If the article had been prepared, packed or kept under insanitary conditions whereby it has become contaminated or injurious to health;
- If the article consists wholly or in part of any filthy, putrid, disgusting, rotten, decomposed or diseased animal or vegetable substance or being insect-infested, or is otherwise unfit for human consumption;
- If the article is obtained from a diseased animal;
- If the article contains any poisonous or other ingredient which is injurious to health;
- If the container of the article is composed of any poisonous or deleterious substance which renders its contents injurious to health;
- If the article contains any prohibited colouring matter or preservative, or any
permitted colouring matter or preservative in excess of the prescribed limits;

- If the quality or purity of the article falls below the prescribed standard, or its constituents are present in proportions other standard, or its constituents are present in proportions other than those prescribed, whether or not rendering it injurious to health.

Table 1.2: Type of foodstuffs Main adulterants

<table>
<thead>
<tr>
<th>Type of foodstuffs</th>
<th>Main adulterants</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Milk and Milk products</td>
<td></td>
</tr>
<tr>
<td>1. Liquid Milk</td>
<td>Water, refined oil, separated (cream less) skim milk solution, water nut flour</td>
</tr>
<tr>
<td>2. Milk powder</td>
<td>Starch, dextrines, water nut flour, rice flour</td>
</tr>
<tr>
<td>3. Milk cream</td>
<td>Other fats, animal fats</td>
</tr>
<tr>
<td>4. Butter and Ghee</td>
<td>Vanaspati ghee, hydrogenated fats and animal fats</td>
</tr>
<tr>
<td>5. Ice Cream</td>
<td>Artificial sweeteners, jelling agents, other fats, water nut flour, none permitted colors.</td>
</tr>
<tr>
<td>b. Vegetable Oils and Fats</td>
<td></td>
</tr>
<tr>
<td>1. Vanaspati ghee</td>
<td>Animal fat and other high melting fats</td>
</tr>
<tr>
<td>2. Edible oils</td>
<td>Palm oil, argemone oil, non-edible oil</td>
</tr>
<tr>
<td>c. Dry Beverages</td>
<td></td>
</tr>
<tr>
<td>1. Coffee Powder</td>
<td>Exhausted Coffee powder, starch, roasted dates, tamarind seeds</td>
</tr>
<tr>
<td>2. Tea powder</td>
<td>Used tea residues, other leaves with added color</td>
</tr>
<tr>
<td>d. Wet Beverages</td>
<td></td>
</tr>
<tr>
<td>1. Wines and beers</td>
<td>Water, spurious narcotics and other concentrated liquids</td>
</tr>
<tr>
<td>2. Soft drinks</td>
<td>Artificial sweeteners (Saccharin), mineral acids</td>
</tr>
<tr>
<td>3. Honey</td>
<td>Colored invert sugar, high concentrated sugar solution</td>
</tr>
<tr>
<td>4. Syrups</td>
<td>Cheap liquids and juices</td>
</tr>
<tr>
<td>e. Spices and Condiments</td>
<td></td>
</tr>
<tr>
<td>1. Whole turmeric</td>
<td>Coating with lead chromate or coal tar dye</td>
</tr>
</tbody>
</table>
2. Turmeric powder Yellow earth, starch or talc colored yellow with coal tar dye
3. Curry powder Starch colored brown with coal tar dye
4. Coriander seed Other green colored seeds
5. Coriander seed powder Powdered bran or sawdust colored green with dye
6. Chilly powder Starch colored red with coal tar dye
7. Mustard seed Argemone seeds
8. Cumin seed Artificial cumin seed like product
9. Black pepper Dried papaya seeds
10. Asafetida Resins and other plant gums

f. Cereals and their products
1. Wheat Stones, straws, low variety grains
2. Wheat flour Talc, chalk powder, tapioca flour
3. Maida Arrow root powder, tapioca flour
4. Sooji Maize flour
5. Rice Stones, straws, low variety rice
6. Semolina Tapioca semolina

g. Pulses and their products
1. Bengal gram dal Khesari dal, arhar dal, bakhla dal
2. Red gram dal (Arhar dal) Khesari dal, bakhla dal, yellow maize flour
3. Bengal gram flour (Besan) Tapioca flour, khesari dal flour, yellow maize flour

h. Miscellaneous Items
1. Processed areca nut Other seeds or nuts broken and colored
2. Processed foods Pickle, jam, chutney and squash of cheap products
3. Sweets Artificial sweeteners, sooji, gur and tapioca flour

1.7 Objective of the study
- Analysis of different adulterants in various food in selected area of Varanasi
• Study of impact of adulterant in selected area among people of different age sex, education, and background
• Study of awareness about adulterants among people of selected area.
• Study of legal awareness among people of different age sex and background.
• Study of impact of media awareness on people of selected area of Varanasi.
• Study of different law in India to protect consumer’s right.

1.7 Importance of Research work

Food adulteration is now a reality and consumers are not aware of many adulterants that are posing serious threat to health and even death. So this study will expose many such adulterants qualitatively and quantitatively in the food that may not