



Source: <https://www.sciencedirect.com/>

3. Metallic Adul

Metallic adulteration is caused by the inclusion of harmful metallic compounds such as arsenic, lead, mercury, and cadmium in foodstuffs. These metallic compounds normally come from industrial pollution, mining, irrigation of sewage, and fertilizers. Continuous intake of such foodstuffs leads to serious health complications such as kidney problems, neurological effects, and cancerous changes.

4. Natural Adul

The first type, natural adulteration, occurs when natural toxic compounds exist in the food item. To illustrate, there are instances when poisonous plant seeds are mixed with certain food grains. There are also instances when certain compounds created by fungi, such as those produced inappropriately stored cereals, pulses, and nuts, lead to the adulteration of such products.

Common Sources of Food Adulteration

Major sources include poor storage conditions, unhygienic processing techniques, the application of non-permitted additives, and lack of awareness among food handlers, and weak regulatory control, which in turn increases the risks of food safety.

3. Common Food Adulterants and Their Effects

Food Item	Common Adulterant	Possible Health Effects
Milk	Water, detergent, urea	Digestive disorders, kidney damage
Spices	Brick powder, artificial color	Stomach pain, cancer risk
Pulses	Kesari dal	Paralysis (Lathyrism)
Oils	Argemone oil	Dropsy, heart problems
Fruits	Calcium carbide	Hormonal imbalance, cancer
Sugar	Chalk powder	Digestive issues
Tea	Used tea leaves, dyes	Liver toxicity

INTRODUCTION

Food is indispensable in maintaining human health, growth, and development. However, food safety and quality are rapidly deteriorating due to the pervasive operation of food adulteration, which has become a serious public health hazard worldwide, especially in developing countries. Due to rapid urbanization, a spiraling rise in population, and increased market competition, crimes of food adulteration have been more common lately.

Food adulteration refers to the intentional addition of inferior, harmful, or useless substances to food items or food products and the removal of valuable nutrients. These practices greatly diminish the nutritional value, quality, and safety of food. The reasons behind adulteration mainly lie in increasing profit margins, enhancing the appearance of food items, prolonging the shelf life of food products, or meeting high demand in the market at a lower cost of production. Adulterated food consumption causes severe health hazards. It creates problems such as food poisoning, stomach disorders, vomiting, and diarrhea due to short-term consumption. The long-term consumption may create severe health problems such as cancer, kidney and liver damage, hormonal imbalance, and neurological disorders. Children, pregnant women, and aged people are the main victims of these effects.

Types and Sources of Food Adulteration

Food adulteration may be categorized into different types depending on the nature, source, and mode of adulteration. This aids in identifying the potential risks and taking necessary preventive measures.

1. Intentional

Under intentional adulteration, the food item is mixed with low-quality or even harmful ingredients for the purpose of earning money. For instance, water is mixed with milk to increase the quantity, starch and detergent are used to increase the thickness of milk, and harmful chemicals like formalin are used to preserve fish and meat, among others. Harmful dyes are mixed with spices, sweets, and drinks to increase their color and promote their consumption.

2. Incidental Ad

Incidental adulteration occurs unknowingly due to various environmental and technological factors. Residues of pesticides used for the protection of food grains, fruits, and vegetables might remain in them due to excessive or improper usage of these substances. Heavy metals detected in food products, including lead, arsenic, and mercury, frequently enter the food chain through soil, water, or air. Adulteration might appear in food products due to contact with packaging materials or storage containers, particularly when they contain dangerous plastics or metals used in their manufacturing process.

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Food Adulteration: Detection and Prevention

संकलन

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Adulterants may:

- Reduce nutritional value
- Cause acute poisoning
- Lead to chronic diseases
- Affect child growth and immunity



Source: <https://fmmagazine.in/>

4. Detection of Food Adulteration

Detection of food adulteration is a very important factor to ensure food safety and protect consumers from possible health hazards. There are several methods to detect adulterants in food products, which include simple physical examination as well as sophisticated methods in a lab.

1. Physical Detection

Physical detection is the most basic detection technique used, which is performed by visually observing food items for any unusual changes in color, size, shape, or texture. Sometimes, adulterated food may reflect vivid or dull shades, or may vary in size. Apart from this, adulteration may also be detected based on unusual changes in smell and taste, such as the presence of chemicals in food products. In addition, food items may also be adulterated due to the presence of foreign materials such as stones, dust, or insect fibers. Even though physical detection is simple, the results may not always be accurate, considering the invisible adulterants.

2. Simple Household Tests

Consumers can conduct home-based tests through household examinations to ensure easy and cost-effective ways to detect adulterated food items. In milk, a drop is placed on a shiny surface. The purity of milk is ensured by flowing slowly with a white trail. In adulterated milk, the mixture flows with rapid speed. In turmeric powder, adding warm water reveals adulterated color, which is a streak due to artificial coloring. In sweets prepared with sugar crystals, adding water to the mixture reveals the presence of chalk powder if present, settling at the bottom. In black pepper powder, adulteration with papaya seeds is detected by adding water to the mixture, as the papaya seeds in adulterated pepper powder float in water.

3. Chemical Detection methods

Chemical detection methods involve the use of specified reagents, chemicals, or test kits in detecting adulterants. The iodine method is found to be effective in detecting starch additives in food items like milk, butter, and flour, where a blue-black color is obtained. The presence of chalk powder in food items like sugar and flour is detected through the hydrochloric acid (HCl) method, where effervescence occurs. The chemical method is found to be more accurate compared to the physical method.

4. Advanced Laboratory Techniques

Precise and accurate results in the detection of adulterants in foods and food products are made available by the use of advanced technology in laboratory testing. This includes the use of techniques such as chromatography, spectroscopy, and mass spectrometry, as well as techniques based on the use of DNA in the detection of food adulterants. These techniques are usually implemented in the hands of government authorities and testing laboratories for purposes of enforcement, quality, and compliance.

5. Prevention of Food Adulteration

The effective prevention of food adulteration involves collaboration at different levels such as consumers, producers, vendors, and government authorities. For effective prevention, it ensures the safety of food products so that consumers have faith in the products.

At the Consumer Level

Consumers play an essential role in the prevention of food adulteration. Consumers who purchase food items carrying brands like FSSAI, AGMARK, etc., which serve as indicators of food safety, help in preventing food adulteration. Additionally, consumers need to avoid foodstuffs that display bright colors, as they may contain too much coloring during the preparation of food items. Moreover, foodstuffs should be procured in preference to those that are fresh in nature, as they are relatively free from artificial additives and other harmful chemical substances. In addition, foodstuffs need to be reported to the authorities in the event of adulteration.

At The Producer and Vendor Level

The producers, processors, and vendors play a very significant role in maintaining the quality of food products. It is recommended that the production of products be carried out by strictly adhering to Good Manufacturing Practices (GMP) to maintain the hygiene and safety of foods. Good and clean handling, processing, and packaging of foods must be maintained to avoid any contaminants. The usage of non-permitted substances and chemicals, as well as preservatives, must be strictly avoided. Proper storage and transportation facilities must be available to avoid spoilage, fungal growth, and the occurrence of chemical contaminants.

At the Government Level

The role of government organizations in controlling food adulteration cannot be undermined since they are helpful in enforcing food laws and regulations effectively in the country. This includes conducting inspections of food processing units and the market to detect any malpractices in the food industry and establishing food testing laboratories to control food adulteration effectively and raising awareness among the public through food safety campaigns about the risks involved in food adulteration.

Food Safety Laws in India

In India, food safety is regulated by the Food Safety and Standards Act (FSSA), 2006, which offers a comprehensive legal framework for food regulation. The Food Safety and Standards Authority of India (FSSAI) is responsible for establishing food safety regulations, enforcing these regulations, food licensing, and ensuring that safe and wholesome food is made available to the consumers.

CONCLUSION AND CONSUMER AWARENESS

Adulteration in food products is a major concern for the world regarding the health, nutrition, and security of human beings. Adulteration in the name of food, i.e., the inclusion of harmful and substandard ingredients in the food we eat, not only decreases the health value of the food but also promotes various acute and subacute health hazards in the process. However, despite food laws, scientific progress, and the contribution of food authorities, nobody can do without consumer awareness in this regard.

Consumers should always remain enlightened and vigilant while dealing with or consuming food. Simple detection methods can be applied by consumers to detect adulteration at an earlier stage. When consumers recognize or suspect a case of food adulteration, it should be immediately reported to the concerned authority to take appropriate and timely measures. Educating families, friends, and society regarding food adulteration and safe food habits can collectively strengthen the resistance to food adulteration. Provision of safe food is a basic human right to live on healthy food, and it is therefore an essential requirement for building a healthy society. Hence, it is collectively important to ensure the provision of pure, safe, and healthy food to society through the joint effort of consumers, producers, food scientists, and all connected parties to build a healthy future society.