



## Food Adulteration: A Review

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**Abstract:** Food is main basic requirement of life. Adulteration is the process can be taken in presence of adulterants. Adulterants are the hazardous substance which is harmful for the health. Adulteration can be done by mainly four ways i.e. incidental, intentional, metallic and natural adulteration. Food adulteration occurs mainly in dairy products, meat, honey, butter, fruits, olive oil, etc. Food adulteration is either the addition of a non-food item to increase the quantity of raw or prepared food intentionally or non food substances added unintentionally. Various health problems occur due to the adulteration in food like risk of causing water born diseases, low digestibility, nausea, vomiting, diarrhea and also some serious conditions like cancer, asthma and cardiovascular diseases, etc. It is necessary to detect the adulterants that should be done by mainly physical, chemical, molecular technique. Most Commonly used methods for detection of adulterations are HPLC, Electrophoresis, DNA method, Chiral chromatography, Mass spectroscopy etc. Detection of food adulterant is more difficult when both adulterant and the food itself have approximately the same physiochemical makeup. Adulterations of food interfere with consumers' right to get safe and good quality foods. So, all responsible individuals, organization, including government should fulfill their responsibility to protect the act of food adulteration and to expose the identified acts. This review provide information regarding various adulterants used in food adulteration, adulteration methods, health issues caused by them and its detection methods, etc.

**Keywords:** Food, Adulteration, Substitution, Quality, Health, Detection.

### I. INTRODUCTION:

Any material which is employed for making the food misbranded or hazardous to body, these materials are called 'adulterants' and the process by which it occurs is called as 'adulteration.' Adulteration has been common problem in the society with few legal controls on food quality by poor monitoring by the authorities. During the time of pre history humans have altered food state to extend or improve its taste. The adulteration term firstly invented in 1820, by the Frederick Accum, a German chemist. He identified most of the toxic metal coloring in food and drinks. After some years physician Arthur Hill Hassall carried out many researches in early 1850s, which led to the 1860 food adulteration act.

According to Guillerma Azuara, adulteration is the act of minimize product quality with object of counterfeiting a pure.

Food adulteration means the addition or substitution of any substance to or from food. So that, the natural composition and quality of food is reduced.

When the food should be declared as adulterated-

- If a substance is added this is hazardous to human body.
- Cheaper substance added in original food.
- Its quality below the standard quality.
- Essential nutrients may not present in it.

**Types of adulteration:**

In addition, the four ways of adulteration are:

1. **Intentional adulteration:** Intentional adulteration may occur due to intention to increase the quantity and to increase the profit this is the main purpose of it. In this adulteration most frequent way is color adulteration. Examples of Intentional adulteration are mixing of water in milk, addition of stone in wheat, rice etc. It is dangerous to health because amount of extraneous substance, add in it so that are done by the business oriented mind just for the earning more many and to make profit. According to Lakshmi et. al. Olive oil, milk, honey, orange juice, coffee is most favour food ingredients are used in this type.
2. **Incidental adulteration:** This adulteration occurs by unintentional or incidental and due to insufficient facilities to maintain food quality. This also includes inappropriate handling and packaging of food by the specified person. This may also occurs due to lack of proper hygienic conditions of food. Examples of incidental adulteration are pesticide residue, dropping of the rodents, etc.
3. **Metallic adulteration:** In this type of adulteration metallic substance are added in it with intention or by the accident. Arsenic from the pesticide, lead from water are some contaminant which could be considered as incidental type of adulteration in food. The Mercury from if you Learn laid from water are also comes under the category.
4. **Natural adulteration:** The natural adulteration means it may occurs due to the presence of different chemicals, organic food or naturally occurring food which are hazardous to health. Toxic varieties of pulses, green vegetables, fishes, etc are the different type of natural adulteration.

**Methods of adulteration:**

- a. Replacement by exhausted drug  
Example: Ginger is mixed with starch, Colour exhausted saffron is coloured artificially.
- b. Substitution with superficially similar but inferior drugs  
Example: Adulteration of clove by mother clove, saffron dry flower of Carthamus Tinctorious.
- c. Substitution by artificial manufacturer substituent  
Example: paraffin wax is tinged yellow substitute for Yellow bees wax, Artificial invert sugar is mixed with honey.
- d. Substitution by sub standard commercial variety  
Example: Alexandrian senna with Arabian Senna, Capsicum minimum substitute with Capsicum annum.
- e. Presence of organic matter obtained from same plant  
Example: Clove are mixed with clove stalks, Caraway and anethum fruits are mixed with other parts of Inflorescence.
- f. Synthetic chemical  
Example: Benzyl benzoate to balsam of peru, citral to oil of lemon grass.
- g. Waste from market:  
Example: limestone in Asafoetida, pieces of amber coloured glass in Colophony.

**Adulteration occurs in Food products:****Dairy products:**

Dairy products mainly classified into common milk and powder milk. Powder milk is mostly used in school meal. Investigation of milk authenticity is widely important in both economic and public health terms. Brazil is 5th largest milk producer in the world. Liquid milk is used to mind target of food frauds. Milk should be adulterated by adding water, neutralizing acidity. Starch is Polysaccharide which is the combination of amylose and amylopectin and contents vary between species to species. The iodine reaction couple with potentiometric analysis is widely used method for determination of starch in milk. Sugarcane is widely means source to form sucrose. It is a disaccharide. The HPLC is used for the qualitative and quantitative determination that results to detect by refractive index.

**Meat and Meat products:** it is the expensive food product. So, there has been interest in measuring quality and composition in order to increase the efficiency of unit operation used in the meat processing.

Meat adulteration can be takes place by:

- i) Capillary electrophoresis that helps to detect the identification of RAW meat species.
- ii) Chromatographic methods that are gas chromatography and liquid chromatography how many used to identify species based on composition of fatty acids.
- iii) Assessment of various analytes in complex mixture is done by immunological methods.
- iv) Determination of fat, moisture done by the NR spectroscopy.

**Honey:** Honey is naturally sweet in taste. Honey is widely used in food industry. It also used as a sweetening ingredient in various products. The price of natural honey bee is much higher than that of sweeteners like cane sugar. Different analytical techniques are used to detect honey such as isotropic, chromatographic, thermal analysis. FTIR technique should be used also. It requires less sample volume and is eco-friendly, because of no sample preparation is required and hence which speed up sample analysis.

**Olive oil:** Olive oil has fine aroma and pleasant taste, and is beneficial in health for its nutritional value. Olive oil is expensive as compared to other oil. Most of Adulterants found in olive oil as seed oils, sunflower, corn oil, soya oil, rape-seed oil, etc.

Detection of adulteration in EVOO (Extra Virgin Olive Oil) is not a simple task; efforts to detect and to determine adulteration traditionally demand monitoring of several organic compounds, to establish a comparison with unadulterated oil, in order to identify change of composition that could be related to adulteration. Chemical methods are used to detect adulteration in virgin olive oil because of gas chromatography and high performance liquid chromatography (HPLC) are having costlier and time period also more.

#### Detection of food adulteration:

To maintain the quality and quantity of food product detection of food adulteration is essential requirement. Various methods are used to detect food adulteration that includes physical, chemical and molecular method.

**a. Physical technique:** Microscopic and macroscopic visual analysis takes place by different physical methods. Different technique like chromatography and spectroscopy are also used to identify or quantify the adulterants in oils.

**b. Chemical technique:** Chromatographic based technique, immunologic based technique electrophoresis based techniques are widely used for detection of adulteration in food.

**c. Molecular technique:** Physical, chemical and biochemical techniques are easy for detection of food adulteration. They may not provide exact qualitative and quantitative results.

#### Analytical methods for detection of food products:

**Table No.1: Common adulterants and its detection**

Product	Common adulterants	Detection methods
Mustard	Argemone seed	Argemone seed rough in nature
Ice cream	Washing powder	In washing powder bubbles are observe.
Honey	Water	A cotton wick dipped in pure honey it burn
Berry jam	Cheaper berries	Hplc
Fruit juice	Diluting with water	Brix
Meat	By adding low quality meat	Electrophoresis
Soya bean oil	Genetic modification	DNA methods
Natural aroma	Non-natural aroma	Chiral chromatography

#### Disadvantages of food adulteration:

Consumer should pay more money to low quality product.

It may cause injury to health.

Shelf life could be reduced.

Quality food product shall be less.

#### Prevention of Food adulteration:

Preventing Intentional Adulteration (IA) was one of the 7 foundational pieces of food safety Modernization act (2011).It should be always approved by FDA (Food & Drug Administration) legal testing of food and adulterants detection is necessary to ensure consumers protection against fraudulent activities. Also there is a need for prevention of food adulteration to avoid various health issues like Nausea, vomiting, origin of water born diseases, low digestibility, asthma, cardiovascular diseases, etc.

#### Conclusion:

Food is the basic need for life. In this food adulteration may occurs by adding, substituting, replacing some of the adulterants. Adulterants are the substances which are hazardous to health. Due to these adulterants food adulteration may occur. There are various types of food adulteration like intentional, incidental, metallic and natural adulteration etc. So, for preventing these adulterations some of the detection methods are used like Microscopy, HPLC, Electrophoresis, Brix etc. To maintain the quality of food the FDA works and approves the high quality products with low side effects.

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