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## Food adulteration and its impact on health

**Pallavi Tomar and Gupta Alka**

### Abstract

Food adulteration is a major harmful cause in both the developed and less-developed countries. "Adulterant" means any substances which could be compelled the food unsafe for containing extraneous matter. The term "adulterant" was defined as, any substances which could force the food unsafe for containing foreign matter. The use of different adulterants like melamine, calcium carbide, argemone oil, synthetic food colours, artificial sweeteners, formalin etc. which is found in food production turns the food poisonous that harms human health and its cause of various serious diseases. Food is one of the basic needs for every living being and is very important aspect for life. But now a days foods are affected by different adulterants. Adulteration is a substance which reduces the vital importance of food adulterants like metanil yellow (an artificial colour) is used to intensify the colour of the turmeric powder also adulterant like chalk powder, brick powder and toxic substances are added to gain profit and to lower cost so as to compete with the market. Such adulterants can lead to anaemia, paralysis, brain damage, stomach disorders and also cancer. Spices may also be contaminated because of conditions under which they are cultivated and harvested. Contaminated spices have been reported to cause certain food-borne illnesses and spoilage.

**Keywords:** Food adulterants, health hazards, food borne illness

### Introduction

Food is very important aspect for life, and it is defined as any substance which is composed of carbohydrates, water, fats and proteins which can be eaten or drunk by humans as well as animals for their nutrition (Choudhary *et al.*, 2020) <sup>[1]</sup>. For every living being, food is an essential need which provides vital nutritive components and it help in the growth and maintenance of human being. But day by day, due to the presence of various adulterants, food is getting adulterated, and the people become the victim of various adulterants, food is getting adulterated, and the people become the victim of various diseases (Reddy and Vineetha, 2021) <sup>[9]</sup>. According to Kharadi (2021) <sup>[10]</sup> for the maintenance of proper health, food gives us major nutrition and plays an important role. For our life, food is one of the basic needs. But to gain profit illegally and earn money by cheating the consumers, many people malconduct the practice of adulteration of food products (Kharadi 2021) <sup>[10]</sup>.

### Adulterants

According to Nagvanshi (2015) <sup>[6]</sup>, the substances which are present in the food and are hazardous to the human health are called as adulterant, in another word, those substances which degrades the quality of food is called as adulterant. The adulterants are found in all the food stuffs viz. milk and milk products, vegetables, oils and fats, spices and condiments, beverages like coffee, tea etc. these are adulterated by various ways. In their daily life these food stuffs are used by every human in the form of food. Adulterants which are present in food stuffs not only lowers the nutritional quality of food stuffs but if we use such adulterated food stuffs for eating purpose daily, then it affects our health very severely (Nagvanshi 2015) <sup>[6]</sup>. According to Churi (2021) <sup>[3]</sup>, an adulterant is a substance which is found in various other substances like food, cosmetics, pharmaceuticals, fuels or many other chemicals that conduct the effectiveness of these substances. In any food products, usually the adulterants are added to increase its volume, weight etc. for either decrease its costing. The adulterants are those poisonous substances, which are added into the food products then the food becomes adulterated, and which may make it harmful to human being (Manasha and Janani, 2016) <sup>[7]</sup>.

The adulterants are those chemical substances which should not be added into the food for legitimate or other health issues. By which the food becomes impure and unsafe for consumption (Mishra, 2016)<sup>[8]</sup>. Food Safety and Standard Act of India (FSSAI) defined adulterants as, "any material which could be employed for making food impure, unsafe or sub-standard or misbranded or containing extraneous matter". The adulterant are that substance which are added or removed from the food products and affects the natural composition and nutritional quality of food products or the substances that is used to reduce the quality of food products is known as adulterants. These adulterants are added in our daily used food products and are harmful for health and it can also cause cancer and some hazardous effect too (Jaiswal *et al.*, 2016). Food adulterants resulting from food manufacturing and processing can also cause adverse effect on human health. These causes various types of diseases like cancer, cardiovascular diseases, kidney and liver dysfunction, hormonal imbalance, reproductive disorders, immune system suppression, mental health problems etc. There are several chemicals which are used as an adulterant like formalin, calcium carbide, melanin; histamine etc. which can cause adverse effect on human health (Mridha, 2011). Food adulterant is defined as those adulterants and substances which are not done only unintentionally by consumers but also turned food non-consumable or sub-standard and also may cause adverse health effects extending from acute symptoms such as abdominal pain, vomiting, asthma, headache, mental retardation, cardiac arrest and chronic effects such as cancer (Oti, 2021).

### History

Adulteration use was first investigated in 1820 by the German chemist Frederick Accum, who identified many toxic metal colonings in food and drink. His work antagonized food supplies and he was ultimately discredited by a scandal over his alleged mutilation of book "the royal institution library". The physician author Hill Hossal conducted extensive studies in the early 1850 which were published in the lancet and led to the 1860 Food Adulteration Act and rather legislation (Ghimire, 2016).

According to Narayan (2014)<sup>[24]</sup> generally foods and drinks are adulterated for the following six reasons. These are:-

- When the demand is more than the supply in the market.
- To come at per with the market competitors by lowering the cost of production,
- The greed for increased profit margins
- The common man cannot afford food items with their original constituents
- Lack of trained manpower with out-dated food processing techniques and
- No idea about the disease outbreaks caused due to adulterated food products.

### Types of Adulteration

Adulteration of food is done by many means but broadly there are two types of adulterations (El-loy *et al.* 2013)<sup>[21]</sup>.

#### Intentional Adulteration

Intentional adulteration is an adulteration in which food items is deliberately adulterated. It is inclusion of inferior substances having properties similar to the foods in which they are added. They are thus difficult to detect. The adulterant could be physical or biological in nature. It is done in order to promote the level of their essential nutrients after

reduction of a given amount in order to increase their profit margin by several chemicals like urea, melamine, and increase its volume by adding substances such as starch, flour, cane sugar, vegetable oil, water, skim milk, sand, chalk powder, molasses, stone, brick powder, ergot, chicory, roasted, barley powder, grinded papaya seeds, etc. into various food items (El-loly *et al.*, 2013)<sup>[21]</sup>. It is the most dangerous form of adulteration because of amounts of nutrients deducted and extraneous substances added into food items that is done by business oriented people just forgot the humanity in behind of money making mentality (Awasthi *et al.*, 2014)<sup>[22]</sup>.

#### Incidental Adulteration

Accidental adulterants are pesticides residues, dropping of rodents, larvae in foods, etc. Metallic contamination with arsenic, lead, mercury can also occur accidentally. Accidental adulterants also involve pests such as rodents and insects that trespasses the food at high degree and produce impurity in the form of excreta, bodily secretions and spoilage through micro-organisms. Most common accidental adulterants are pesticides, D.D.T and residues present on the plant product (Pandit *et al.*, 2002)<sup>[23]</sup>.

### Some Food products and their Adulterants and Impact on Human Health

#### Oils and Fats

According to Sasi rekha and Paul (2018)<sup>[5]</sup>, In oils and fats, argemone oil is found as an adulterant which causes various diseases on human health like epidemic dropsy, glaucoma, blindness, cardiopulmonary arrest. Pesticidal residue is an adulterant which is found in most of the varieties of food products. It causes various diseases like acute or chronic poisoning with damage to nerves and vital organs. Mineral oil is an adulterant which is found in oils and black pepper. It causes diarrhoea, vomiting, cancers etc. Methyl alcohol an adulterant found in alcoholic liquors, causes blurred vision, blindness and death (Sasi Rekha and Paul 2018)<sup>[5]</sup>.

#### Turmeric Powder

Lead chromate is found in turmeric and powder mixed spices within all type of adulterant and causes anaemia, brain damage etc. Metanil yellow is an adulterant which is found in turmeric, collective form spices, saffron, pulses without husk, rice, beverages and cause tumours, cancer, testicular degeneration in males etc. (Sasi rekha and Paul 2018)<sup>[5]</sup>.

#### Pulses

Kesari dal is an adulterant which is found in pulses and besan causes paralysis of legs. Dung is an adulterant which is found in coriander leaves and cause tetanus. In suji, a tea leaf, iron fillings is found as an adulterant and cause possibility of tetanus (Sasi rekha and Paul 2018)<sup>[5]</sup>.

#### Milk and Milk products

According to Gawali (2021)<sup>[4]</sup>, water may be an adulterant which is commonly found in milk and decreases the nutritional value of milk which is a serious concern for human health. In milk and milk powder, melanine is found as an adulterant which cause renal and urinary problem and even newly born death. Urea is an adulterant which is found in milk and causes hazardous effect on human being like acidity, indigestion, ulcers and cancers. It is also harmful to heart, liver and kidneys. Detergents are the adulterants which are added into milk to emulsify and gives from solution and the

the characteristics white colour of milk and causes gastro-intestinal diseases in to humans. Hydrogen peroxide is adulterants which are added into the milk to keep up the freshness of milk for a longer time. Starches are an adulterant which is also found in milk and cause various diseases. It causes diarrhoea when undigested starch accumulates into the colon. It is very fatal for diabetic patients. Neutralizers are the adulterants which are added into the synthetic milk to neutralize the acidic effect. It causes hypertension and heart ailments. Chlorine is an adulterant which is also found in milk. It causes clogging in arteries and develop heart problem. In milk, preservatives are also used as an adulterant which causes abdominal pain, diarrhoea, vomiting and other poison related symptoms. Pesticides are also an adulterant which is found in milk. It is carcinogenic in nature and cause serious health hazards (Gawali 2021) [4]. According to Chaudhary (2019), vanaspati, anatta and oleomargarine are an adulterant which is found in ghee and causes acute renal failure. Water and skim milk are an adulterant which is found in milk and cause stomach disorders. In condensed milk, paneer and khoya are found as an adulterant. It also can cause stomach disorders. Starch, rice powder or wheat flour is an adulterant which is found in ice-cream. It causes various diseases which affects lungs, kidney and heart. In butter, the adulterants are vegetable oil, anatta, banana, and oleomargarine. It causes food poisoning in mustard oil, papaya seeds are found as an adulterant it can cause epidemic dropsy and severe glaucoma (Chaudhary 2019).

### Black Pepper

According to Dongre *et al.*, (2020) [2] in black pepper, papaya seeds are found as an adulterant. It can cause severe liver problems and stomach disorders. In green chillies and peas, the adulterant is malachite green. It is extremely carcinogenic in nature. Brick powder is an adulterant which is found in

chillies powder. It causes stomach disorders in sugar, the adulterant is chalk powder. It can cause stomach disorders. In coffee, the adulterant is chicory, roasted barley powder, tamarind seeds. It causes various diseases like diarrhoea, stomach disorder, giddiness and severe joint pain. In wheat, the adulterant is ergot (poisonous fungus). It is highly poisonous and cause harmful impact on human being. In honey, the adulterant is molasses, cane sugar. It also can cause stomach disorders. Chalk powder is an adulterant which is found in Jaggery. It cause vomiting and diarrhoea. In tea, foreign leaves or exhausted tea leaves are found as an adulterant. It can cause hazardous effect on health and carcinogenic in nature. In oils the TCP is found as an adulterant which causes paralysis. Sand, marble chips, stones, filth are an adulterant which is found in food grains, pulses etc. it damages digestive tract. Mineral oil, petroleum is an adulterant which is found in edible oils and fats, black pepper etc. it can cause cancer. Lead chromate is an adulterant which is found in turmeric whole and powdered, also in mixed spices. It can cause anaemia, abortion, paralysis, brain damage etc. (Dongre *et al.*, 2020) [2].

### Fruits

Arsenic is an adulterant which is found in fruits such as apples sprayed over with lead arsenate. It can cause dizziness, chills, cramps, paralysis, death, wrist drop etc. In drinking water, sea foods, tea etc. fluoride is found as an adulterant. Excess accumulation of fluoride cause fluorosis *i.e.*, mottling of teeth, skeletal and neurological disorders. Pesticidal residue is an adulterant which is found in all types of food. It causes acute as well as chronic poisoning with damage to nerves and vital organs like liver, kidney etc. Oxalic acid is an adulterant which is found in spinach, amaranth etc. it causes renal calculi, cramps, failure of blood to clot (Dongre *et al.*, 2020) [2].

**Table 1:** A list of some of the food products being adulterated by food adulterants and their harmful effects on human health:-

Food Products	Food Adulterants	Impact on Health
Milk	Water, starch, urea, extraction of fat	Digestive system disorder
Sugar	Chalk Powder	Stomach infections
Tea	Artificial pigments/dye, iron fillings	Liver disorders, cancer
Coffee powder	Tamarind and date seed powder, saw dust	Diarrhea
Salt	White powder, stone, rawa	Stomach disorder
Chilli powder	Artificial colors, brick powder, sudan dye	Blood and lung cancer
Turmeric	Lead chromate, saw dust, metanil yellow	Carcinogenic
Mustard seed	Seeds of prickly poppy argemone	Epidemic dropsy, glaucoma
Black pepper	Dried papaya seeds	Cardiac arrest, injurious to health
Pulses	Kesari dal, metanil yellow, clay, stone	Lathyrism, carcinogenesis, stomach disorders
Butter	Margarine, starch	Food poisoning
Honey	Fructose syrup/cane sugar	Stomach disorder
Sweets juices	Coal tar dye/metanil yellow	Cancer, toxin released
Rice, wheat	Mud grits, soapstonesbits, sand, Ergot	Cancer, genetic mutations harm the human reproductive system
Green chillies/green peas	Malachite green	Cancer
Vegetable oil	Argemone mineral oil	Heart disease, skin infection and cancer
Ghee	Ghee essence, vanaspati, sweet potato, mashed potato and starch	Cancer, acute renal failure
Carbonic drinks	Aluminium leaves	Asthma, lung disorder
Ice creams	Detergent powders	Skin and lung disease
Sea food	Mercury, Arsenic	Stomach and brain disorder

Source: Adapted from Bansal *et al.* 2015 [18]

### Effect of Adulteration on Human Health

The adulterated food substances if used regularly can cause some symptoms like headache, gastro-intestinal disorders, muscular pain, drowsiness etc. (Ram *et al.* 1993). For example, the argemone oil used to adulterate ghee and butter is highly toxic as it causes a disease known as dropsy characterized with the symptom of the presence of fluid collecting in some parts of the body (Sharma *et al.*, 1992).

Dropsy affects the normal body function and may experience intestinal disorders after regular use of powdered sugar and other food items being adulterated with washing soda (Thakur *et al.*, 2009) [11, 19]. Human health is highly sensitive to food adulteration. Hazardous effects of food adulteration is associated with diarrhoea, abdominal pain, nausea, vomiting, eyesight problem, headache, cancer, anaemia, insomnia, muscular paralysis and brain damage, stomach disorder

giddiness, joint pain, liver disorder, dropsy, gastrointestinal problems, respiratory distress, edema, cardiac arrest, glaucoma carcinogenic effects, kidney failure, digestive system disorders etc. as reported by (Anita and Neetu 2013)<sup>[25]</sup>. It is found that there are various chemicals and colours used in fruits and vegetables which are very poisonous for health (Faraz *et al.*, 2013 and Lakshmi *et al.* 2012)<sup>[26, 27]</sup>.

### Food Borne Illness Due to Adulteration

The humans affected by several diseases after the consumption of adulterated food products. Some diseases are loss of vision, heart diseases, appendicitis, small intestine problem, respiratory diseases, anaemia, epilepsy, neurotoxicity etc. (Manasha and Janani 2016)<sup>[7]</sup>. After consumption of contaminated food, the people ill from various diseases like nausea and vomiting, diarrhoea, weakness, fever, cancer, goitre, paralysis etc. (Thakur, Walia and Singh, 2009)<sup>[11, 19]</sup>. The various diseases caused after the consumption of adulterated food e.g., severe glaucoma, gastritis, teeth mottling, typhoid, food poisoning, dysentery, botulism, liver damage etc. (Rasul *et al.*, 2013)<sup>[12]</sup>. As reported by Faraz *et al.*, (2013)<sup>[26]</sup> food adulteration causes various food borne disease like abdominal pain, nausea, vomiting, eye sight problem, insomnia, muscular paralysis, brain damage, edema, cardiac arrest, stomach disorders, giddiness, kidney failure, digestive system disorders etc. Food borne diseases include intoxications and infections through consumption of contaminated food are referred as food poisoning. Defects in the product, adulteration and false advertisement and poor quality of products cause food borne diseases (Excelce, 2015)<sup>[13]</sup>. The term food poisoning in its wider sense comprises all diseases which results from ingestion of food containing non-bacterial or bacterial products. The major symptoms of food borne diseases are headache, giddiness, vomiting, diarrhoea, slow pulse, rigors and cramps etc. (Anant, and Bhagat, 2018). In the food industry, the food poisoning is a worldwide challenge that arises from both formal and informal sector. Food borne microorganisms play an important role in correlation between food and human health from a dual means. Infact, even the introduction of strict rules and regulations and new technologies to ensure food safety and quality, the food pathogens continue to cause infections and diseases and preventing a serious public health concern (Siciliano and Mazzeo, 2019)<sup>[15]</sup>. In every year, millions of people worldwide suffer from food borne illness resulting after the consumption of contaminated food and day by day which has become one of the most worldwide public health problems. In many countries, peoples are suffering from the food borne disease because of consumption of foods produced under unhygienic condition, lack of hygiene education, drought, contaminated water, improper food storage etc. Food borne illness are the indicatory of the spread of public health problem in both developed as well as in developing countries. Although these issues have an important impact on health and economics in developing countries. Factors commonly related with the epidemic of food borne diseases include improper food storage, contamination of tools, poor hygiene condition and improper cooking etc. (Miri *et al.*, 2017)<sup>[16]</sup>. Food poisoning/food borne illness is an abdominal illness which is caused by eating contaminated food such type of food includes poorly prepared, cooked at wrong temperature or as a result of poor hygiene. This contamination including bacteria, viruses, toxins or parasites. This is a common illness which ranges from mild to severe, even life-threatening conditions,

the degree of severity of food poisoning will depend upon the cause (Prashanth and Indranil, 2016)<sup>[17]</sup>.

### Conclusion

To protect the health of the consumer along with their rights must be the primary goals. Apart from this, day by day the food industry facing the challenging issues like preventing food fraud or wrong practices. So, the food industry and constructor must take part to control the danger of food adulteration. As well as, it is necessary that every consumer should always be aware while the selection of food items just because of this we can prevent our health from different types of adulterants which is found in food products and cause harmful impact on human health. So, it is necessary to aware every consumer do not consume of such type of hazardeous food products. Food adulteration is a great cause of concern as it affects human health directly.

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