

Food Items Commonly Found in Every Households that are Affected by Food Adulteration: A Review

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Abstract:- Food adulteration is the act of deceiving the consumers so as to make a financial profit. Adding these adulterants change the properties of the food items by altering the colour, flavour, fragrance, appearance, texture and other properties of food products which make them appealing to consumers. Even food items like milk, dairy products, food grains, cereals, pulses fruits, vegetables, etc. are not free from adulteration. Adulteration can either be added intentionally or unintentionally, though more often, adulteration is done intentionally to make a financial benefit. To protect the consumers from these harmful adulterants, the FSSAI has placed many acts, regulations and rules to monitor and stop the production and distribution of these substances. The rate of food adulteration is increasing rapidly in India, to feed its 1.44 billion population, and across the globe. Recent global events, like the COVID-19 pandemic; rising inflation; the crisis in Sri Lanka due to bankruptcy since 2022, the ongoing Sudan conflict, the Israeli war with Palestine and the Russia-Ukraine war are some of the events that has not only has increased the demand for food supplies but has also affected the production, transport and distribution of food across the world. In this article, various commonly found food products are identified and they are reviewed with the help of various published literatures to see if the food products actually do contain adulterants.

Keywords:- Food Adulteration; Food Items; Household; Adulterants; Abbreviations: MUFA-Mono Unsaturated Fatty Acids; PUFA-Poly Unsaturated Fatty Acids; MSP: Minimum Support Price; DNA-Deoxyribonucleic Acid.

I. INTRODUCTION

Food can be defined as anything we eat, containing carbohydrates, proteins, fats and micronutrients which provides us energy and helps us do our daily functions with ease. Food is a basic necessity for survival. The demand for food is increasing but it's reduced production has led to the compromise in quality and purity of food while keeping up with the nutritional demands of the rapidly growing population. Various other factors like global warming has

caused unpredictable temperature making it tough to grow crops; industrialisation and urbanisation has led to reduced land for cultivation of crops; unavailability, inadequate quantity and increased cost of pure ingredients or raw food materials e.g. coffee beans, pulses, fruits, vegetables, etc. from the producers/farmers to prepare and produce food products are some of the many reasons why people resort to addition of impurities to their product. These include use of colouring agents like metanil yellow instead of turmeric, Sudan red instead of actual chilly powders; chalk powder and corn starch to add bulk or volume to powders of spices; reusing and selling used tea leaves that should be discarded are some of the commonly used adulterants. These added impurities, also called adulterants, in their own ways, attract the customers by their bright colour, flavour, fragrance, bulk and texture which resemble the natural products. People are also deceived with false advertising telling that their product is of a "Superior" quality and that it is verified by various organisations, which is not the case.

Adulteration (of food products) is done by adding substances to food products to deceive the consumers and reduce the quality of food products, in most if not all cases. Most common example of adulteration is mixing of ethanol in petrol, and in the food industry, it can be as minute as adding more water to milk (in order to dilute the milk and increase the amount of milk that can be sold) which can lead to nutritional deficiencies especially in children, to adding lead chromate in turmeric and arsenic to pesticides and using calcium carbide as a food ripening agent, which on long term exposure can lead to serious systemic damage including acute causes like organophosphate poisoning to chronic causes like nephropathy, lead colic and lead lips, encephalopathy, peripheral neuropathy, growth retardation and even impotency on prolonged consumption of such foods. [1]¹

➤ *The Food Safety and Standards Authority of India:*

The food we buy is adulterated, whether be it with formalin added in water as a preservative to the meat we eat, which is loaded with hormones and antibiotics, and the drugs we take, which are substandard, impotent or even placebos at times. Therefore the food we eat should be made safer for us to consume it and this is moderated and regulated in India by

¹ Reference: 1

the Ministry of Health and Family Welfare, GoI via the Food Safety and Standards Authority of India (FSSAI) by the food safety and standards act, 2006 and its 2 amendments; the food safety and standards rules ,2011 and its 4 amendments; the various food safety and standards regulation from 2010-2023.[2]²

➤ *Adulteration:*

Adulteration, as already mentioned, can be said as the addition of undesirable or the removal of desirable substances which reduces the quality of the food product and also deceives the consumer into purchasing these sub-quality products. The substances which are added into food products are called adulterants. These adulterants, which are added in food products, are either added intentionally or unintentionally and based on this, adulteration can be divided into three main types:

- **Intentional Adulteration:** It includes the deliberate addition or removal of substances e.g. mixing stone and pebbles with grains, adding pesticides and ripening agents to fruits.
- **Unintentional Adulteration:** It occurs due to addition or removal of substances due to negligence, carelessness or poor hygiene practices e.g. microbial contamination and larvae in food.
- **Metallic Adulteration:** It occurs due to addition of metallic compounds intentionally or unintentionally during the process of crop production e.g. addition of pesticides during crop production for killing the pests is unintentional but using them as a preservative knowing their harmful effects, can be classified as intentional adulteration e.g. usage of lead, arsenic and mercury.[3]³

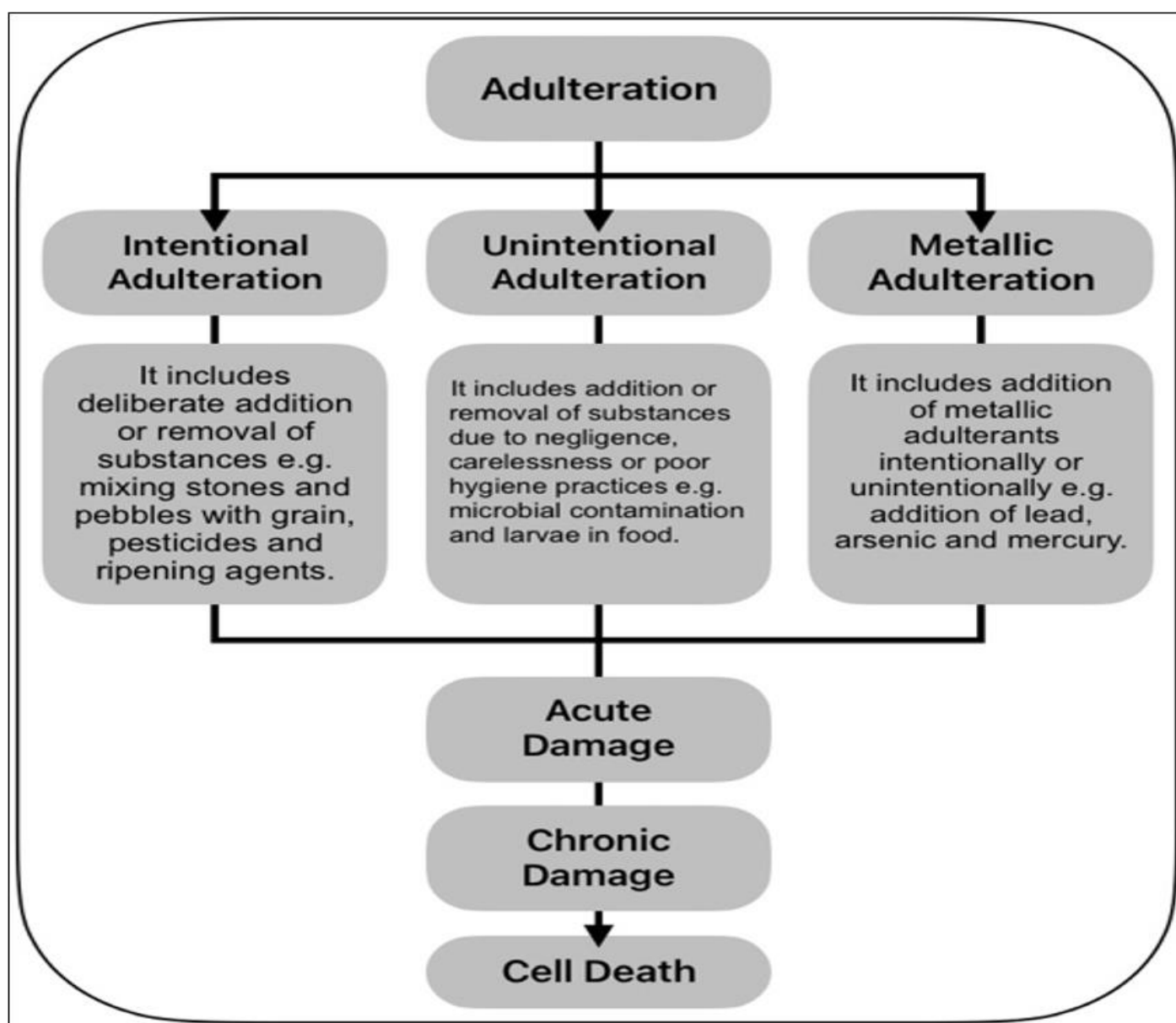


Fig 1 Types of Adulteration and their Effects

² Reference: 2

³ Reference: 3

II. ADDITIVES AND ADULTERANTS

While adulterants are substances added to food products to alter the nutritional status and deceive the consumers, either intentionally or unintentionally, additives are substances added intentionally into the food products to give it flavour, colour and other important characteristics of the food product, and in some cases, can even define the characteristics of the food product. These additives are approved for use in food preparation and are considered safe and healthy for us, as they are manufactured and produced following the rules and regulations of the FSSAI and/or other internationally recognised institutions, unlike the adulterants, which are mostly considered unsafe and unfit for health. Another important point to keep in mind is that, while additives act more often as a taste enhancer or preservative enhancing the quality of food, adulteration is done more often to make a profit.

➤ *Aims and Objectives:*

The aim of this study is to review various literatures and studies that are already present and to make a list of a food items commonly found in households that are affected by food adulteration.

➤ *The Objectives of this Study are:*

- To make a list of the most common food products that are used in day-to-day life
- To find out the various commonly used adulterants added in these products
- To conclude by saying that the food we eat are actually healthy or contaminated with adulterants.

III. FOOD ITEMS AND THEIR ADULTERATION:

There are various food items we use daily, from milk, rice, cereals and pulses that we eat everyday to sweets, juices, jams, candies and meat that we eat occasionally. Based on the literature already present, these are some of the common food products found at most homes and their contamination by addition of adulterants.

➤ *In Milk:*

Milk is considered as one of the most nutritious foods that is available to us containing fats, carbohydrates, proteins and micronutrients like calcium that is essential for bone growth and in general, it is necessary for the growth of any human being, especially for children. It is consumed by everyone irrespective of their age, sex, race and religion. This increases the demand for milk when the supply of milk is less. Milk is adulterated by simply diluting the milk with water, to increasing the volume of milk for production which could decrease the nutritional value of the milk per glass or they can inject hormones like oxytocin into cows to increase the volume of milk produced by the cows. A study in the 1990s showed that injecting oxytocin into cows daily, increased the

amount of milk produced by more than 3kg (as measured in containers).[4]⁴ Another study showed the presence of Melamine (a nitrogenous compound, used to mask the real protein levels in diluted milk)[5]⁵ in milk lead to more than quarter million morbidities, fifty thousand people hospitalised and around 6 deaths in China.³ These measure not only reduced the nutrient content of the milk but also increases toxicity in our body due to these chemicals and hormones building up in our body on prolonged exposure. These chemicals especially melamine is said to cause renal damage over time leading to a global concern about the safety of milk.

➤ *In Milk Products:*

As milk is adulterated, even without trying, milk products are naturally adulterated too. Milk products like curd, buttermilk, butter and ghee are adulterated with products like mashed potatoes, vanaspati, and starch powder. This most commonly leads to stomach disturbances and gastrointestinal disorders.[6]⁶

➤ *In Tea and Coffee:*

Coffee and tea are the most widely used beverages. From when we get up, to when we are stressed and also to keeping ourselves alert and active, we use these products every step of the way. Tea and coffee have a global market and are a part of all our lives, so much so that they are classified as addictive substances which causes mild withdrawal symptoms, if the consumption is stopped suddenly, especially with coffee. Due to their increasing demand, these products are also adulterated to mainly make profit. Tea is adulterated by adding exhausted or used tea leaves, iron filings, leaves which are not even from tea plant, using artificial agents for colour, flavour and fragrance. Tamarind seed or date seed is mixed with coffee powder with sometimes even chicory powder being used.^{3,6}

➤ *In Sugar and Jaggery:*

Jaggery is considered as a natural product compared to sugar, which is a highly refined, processed and polished form of jaggery. Jaggery is a natural sweetener obtained from sugarcane and is a very good source of iron for our body. Washing soda, chalk powder and urea are some of the adulterants used in reducing the quality and the nutritional status of Jagger and sugar.⁶

➤ *In Fat and Oil Products:*

The fats and oils used everyday in cooking is majorly obtained from plant sources like coconuts, sunflowers and groundnuts. The edible oils and fats can be classified into two: MUFA and PUFA. PUFA are generally considered to be safer than MUFA and the major sources of PUFA are fish oil, seeds of flax and flax oil and sunflower oil while, major sources of MUFA are milk products, olive oil, nuts and seeds. Fats, none the less, are essential for the production of energy; act as a layer of cushion around the body and the vital organs, protecting them from damage; helps in normal cell membrane synthesis, steroid synthesis and synthesis of surfactants in

⁴ Reference: 4

⁵ Reference: 5

⁶ Reference: 6

lungs. The adulteration of these fatty acids and oils leads to the reduced normal body function and can also lead to loss of fats that can harm our organs directly e.g. kidneys which are cushioned and surrounded by layers of fat. These edible oils are adulterated by replacing high quality standard products with low quality oils which are unsuitable for consumption and by adding mineral oils, karanja oil, castor oil, vansapati and artificial colours.⁶ Oils are also processed and refined to produce substances like trans-fats and steradienes, which are normally not present in oil, and are directly linked to coronary heart diseases.³

➤ *In Legumes and Pulses:*

Legumes and pulses are the main source of proteins for our body, especially for vegetarians, other than meat. Proteins are generally required for the overall growth of our body, from formation of receptors and hormones to the growth of muscles and production of clotting factors and potent immune system to fight against infections. Proteins are also a source of energy though it yields a lesser amount when compared to carbohydrates and fats. The adulteration of legumes and pulses are done simply by mixing small grain sized stones and plastic beads with the pulses e.g. it is done while selling green gram and Bengal gram. In this way, the farmers get a higher MSP while selling it to a seller and the seller sells lesser food grains and more stones for the same value, leaving their costumers at a loss. We can also observe water being sprinkled frequently to keep the legumes and pulses fresh which at the same time leads to the pulses getting infested with insects and worms and also make them denser since these pulses imbibe the water and swell up. Other adulterants added are dust, straw and weed (as seen with coriander and other leaves), weed seeds and even damaged seeds.^{3,6}

➤ *In Food Grains and Cereals:*

Rice, wheat and ragi form the staple food of India, providing energy in every meal. Though the culture of India is mixed with rice and wheat available in various parts of India, rice and ragi are predominantly consumed in South India, whereas wheat is predominant in the North. These food grains e.g. rice, wheat, ragi, jowar, rusk, sooji and rawa form the majority of our meals and are the principle factors which give us energy for our day-to-day activity due to their proportion of consumption compared to the other foods like, pulses, pickle, meat, and vegetables. These food grains are adulterated with added colours like tartazine (as seen with rusk), with living insects and edible grains (as seen in rice), lumps, jute threads, stones and living insects (as seen with ragi).[7]^{6,7}

➤ *In Fruits and Vegetables:*

Fruits and vegetables are the main sources of micronutrients like vitamins and minerals which are essential in our daily diet. They protect us from vitamin deficiencies like scurvy, night blindness and collagen related diseases. Not only do they naturally contain pesticides and insecticides, they also contain adulterants by simply dipping them in ripening agents, dyes and chemicals. Fruits like papayas, apples, bananas and tomatoes are exposed to chemicals which

are added mainly to give them colour and also to ripen them. The colours and dyes added to the fruits and vegetables can be identified by rubbing the outer coat of the fruit with our fingers or by keeping them in warm water for a while or by cutting them open where we can find only the outer coat of the fruit and/or vegetable appearing to be ripe but the inner actual fruit still remains to be raw. Chemicals like malachite green, calcium carbide, copper sulphate, oxytocin, saccharin and wax are used to coat the fruits as ripening agents and as dyes.⁶ These pesticides, insecticides have harmful toxic substances like arsenic that not only causes irritation of the skin and gastrointestinal tract but also can cause blindness; toxicity of the gastrointestinal tract, nervous system, heart and skin; cancers of the kidneys, bladder, lungs and skin and also cause DNA damage on prolonged use.¹

➤ *In Spices:*

Spices are of high economic value adding colour, taste, fragrance to every food, especially turmeric which is said to help us with immunity and is also applied on wounds as antiseptics. But the quality of these spices are lowered by adding lead chromate, metanil (used to give yellow colour to turmeric), corn starch, coloured talk, saw dust (adds volume to the powders), brick powder and Sudan Red (used in red chilli powder), dust, horse dung, starch (used in cumin powder), Papaya seeds (used as black pepper), husk, ash (used as coriander powder).[8]^{3,6, 8} Cumin seeds are adulterated with coloured grass seeds, saw dust and charcoal dust which causes stomach disorders; turmeric powder is adulterated with pesticide residue, saw dust, chalk dust, dyes, arsenic and lead causing cancer and gastrointestinal disorder; mustard seeds are adulterated with argemone seeds causing gastrointestinal and colic disorders; pepper with dried papaya seeds and blackberry which causes allergic reactions.⁶ Moisture and salt are also added into the packets of spices and their powders which makes them impossible to check their quality before buying the product.⁷

➤ *In Honey:*

Honey is said to be one of the most natural sweeteners without much processing required. Artificial sweetness are added to honey like sugar and sugar syrup, bananas, molasses from sugarcane are added to adulterate the product.

➤ *In Jams and Juice:*

These sweet jams we eat with bread and the packed 'refreshing' juices we eat and drink respectively, contain adulterants like non-permitted dyes like metanil yellow, artificial food dyes, colours and flavours. It is more shocking to know that most of these juices and jams don't even contain the fruits themselves but contain chemicals additives and adulterants in the name of real fruit 'extract'.

➤ *In Meat:*

Animal husbandry is a huge industry including various subdivisions like pisciculture, fishing, poultry and cattle rearing where animals are reared for the sole purpose of obtaining animal products like wool, eggs, cord liver oil, meat, leather and other animal products. Meat production is

⁷ Reference: 7

⁸ Reference: 8

particularly a huge industry, due to the demand for meat as protein and also as a staple food in many countries like in the US. Adulterations of meat can be done by just replacing one meat with the other e.g. this is especially seen in hotels where beef or pork is cooked as mutton, or when old rotten meat is cooked and served as new meat or over cooker meat. Other forms of adulterations include: use of artificial enhancements like the use of forbidden veterinary drugs, misuse of food additives, use of industrial and nonedible substances; adulteration with other animal ingredients; use of sick and dead livestock and poultry, unclean, poisonous, expired, low quality meat of unknown origin; illegal importation of meat or meat with improper certificate and approval.^[9] All these cause gastrointestinal disturbances leading to food poisoning, gastrointestinal ulcers and perforations

➤ *In Sweets:*

Sweets and other delicacies are pretty common in every home. They are present in every house to give guests, to celebrate festivals, to rejoice good results in exams, or to just sweeten our mouth. No matter the reason, there are sweets in every home and chances are that these sweets are not done at home but are brought from shops. And these shops too add adulterants to these sweets to attract their costumers e.g. every shop has their own variant of yellow for their jalebi. Presence of nonpermitted colours is used to attract the costumers by making the sweets more appealing, but if the shop is not maintaining their sweets properly or if they haven't refrigerated their sweets properly, chances are that we'll get food poisoning eating these sweets which will have fungal and bacterial growth on them. Plus, since they are mostly made of sugar, honey and jaggery, the chemicals of these sweeteners react with heat to produce reactive compounds that are not favourable for our stomach.^[10]^{7,10}

IV. CONCLUSION

There is no extensive research on various food products done as such, but there are more and scientific studies done on the already existing important products e.g. food grains, pulses, cereals, fruits and vegetables, meat, sugar and jaggery. Once you go beyond these food products, there are very few literature on other food products and their adulterants. This is probably because these food products act as primary ingredients for any food item prepared or this tells that we haven't been able to detect any more of the additives and adulterants since many, if not every articles and textbooks mention the same chemicals and food adulterants. Adulterants are being used extensively in every food product and we can barely find pure substances anywhere. In other words, adulterants are being the new normal just like additives have become and this can't be helped because to feed the increasing demand and that vast population that is ever growing, either the rich get pure products or everyone gets impure and unsafe products. It is comforting to know that, even though our food is turning into poison day by day, we have the medical advancements to detect signs and symptoms of various diseases, including cancer, in their early stages and treat the underlying conditions, which is directly

reflected on the growing life expectancy of the global population. Adulterants are being added to everything, from the milk we drink everyday, across all age groups to meat and even the drugs we take for controlling our diseases. Purchasing food items from a trusted and known source which is FSSAI approved is very important as these products can be trusted.

➤ *Availability of Data:*

This paper is written as a review of the previous published data

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