

A Study on Food Adulterants and its impact on human health

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Abstract:

Food adulteration is a global issue and underdeveloped countries are more vulnerable to it due to a lack of monitoring and legislation. Food adulteration has been a source of concern since the dawn of civilization as it not only lowers the quality of food products but also has a number of negative health consequences. However, this is one of the most widespread phenomenon that has gone unnoticed in many countries. Unfortunately, contrary to popular assumption for milk adulterants can offer major health risks leading to lethal infections. This study provides a full discussion of common milk adulterants as well as various methods for detecting the adulterants both qualitatively and statistically. Concerns about food safety and regulation have resulted in the development of several approaches for adulterant detection in food, such as physical, biochemical/immunological and molecular techniques. This study is structured to be an 'adulterant-based' study rather than a 'techniques-based' one, with qualitative detection methods enlisted for the majority of frequent adulterants and quantitative detection methods limited to a few key milk adulterants. Aside from standard procedures, significant advancements in these detection techniques have also been reported.

This review aims to add to the body of information about potential milk adulterants and detection methods.

Key word: Milk processing, Adulteration, food safety, detection methods, adulterants

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I. Introduction:

Since the discovery of Melamine contamination in Chinese newborn milk products in 2008, concerns about milk and dairy product adulteration spread across the globe (**Xin & Stone, 2008**). The history of adulterated milk, however it is very old. According to reports, the Swiss Milk Scandal claimed 8000 infant lives in New York alone in 1850. Milk is regarded as the "perfect diet" since it contains a wealth of nutrients that are needed by both infants and adults. It is a top source of vitamins, minerals, fat, carbohydrates, and protein. Unfortunately, adulteration of milk is fairly simple to do everywhere in the world. Possible causes It may have several causes, such as an imbalance between supply and demand, the perishable nature of milk, poor client purchasing power, and a lack of appropriate diagnostic tests (**Kamthania et al., 2014**). Food fraud has an economic incentive, but it has genuine public health implications (**Singh & Gandhi, 2015**). Due to a lack of appropriate law enforcement and adequate monitoring, the issue is substantially worse in developing and poor nations. Chemical reactions make it simple to qualitatively detect adulterants in milk, although quantitative detections are more difficult and varied. Quantitative detection methods vary depending on the type of adulterants found in milk. Examples include Liquid Chromatography (LC) and Enzyme-Linked Immunosorbent Assay (ELISA), which are frequently used to identify foreign proteins; Polymerase Chain Reaction (PCR) and polyacrylamide gel electrophoresis (PAGE), which are frequently used to identify adulterants in milk of a particular species. Techniques for detecting milk adulteration must be exceedingly precise and swift since fraudsters have dodged punishment by claiming that more traditional detection methods are ineffective (**Garcia et al., 2012**).

II. Materials & Methods

Food items such as milk, butter, mustard oil, honey, pulses, wheat flour, black pepper, chilli powder, and coffee powder were obtained from various departmental and local grocery stores. Some reagents, such as Iodine reagent, Concentrated HCl, Sucrose, 0.5N ethanolic KOH, Concentrated HNO₃, Solvent ether, Resorcinol, Carbon tetra-chloride (CCl₄), and

Chloroform, were gathered and utilized in biochemical experiments. Adulterants are detected using qualitative assays. We created specific reagents based on the sample for qualitative analysis in order to evaluate the colour change or appearance of the sample in response to adulterants present in the sample. Adulterants in milk will turn blue with prepared Iodine reagents, adulterants in butter will turn maroon with concentrated HCl and a pinch of sucrose, adulterants edible oil will appear turbid and will separate, yellow, orange, or crimson colour lower acid layer with prepared reagents for two types of adulteration, adulterants honey will turn cherry red with prepared reagents, adulterants honey will turn cherry red with prepared reagents.

➤ **Food adulteration in India**

Food adulteration cases were consistently on the rise, according to the Food Safety and Security Authority of India (FSSAI). Tamil Nadu, Jharkhand and Uttar Pradesh had the greatest percentage of tampered samples. From the 2461 samples collected, 485 in the National Capital were contaminated. (<https://fmtmagazine.in>).

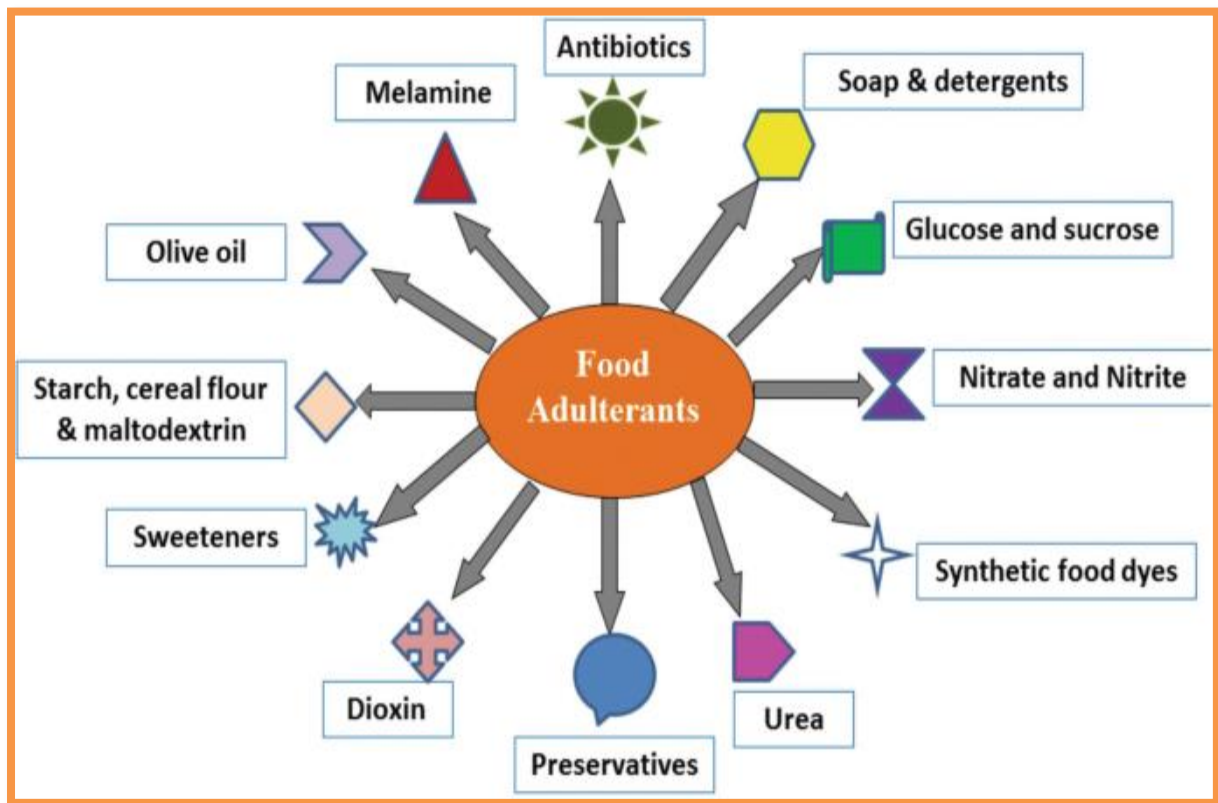
III. Types of adulteration and food items

A variety of conditions, including excessive demand or seasonality in supply, can lead to the contamination of various food products and/or beverages. Numerous authors claim that (**El-loly *et al.*, (2013)** and **Narayan (2014)**) adulterations might be planned, unintentional, or accidental.

Intentional/deliberate Adulteration:

This Adulteration is a sort of adulteration when ingredients are purposefully added to food products to increase its volume and boost the quantity of their important elements. Due to the substantial nutrient removal from food and the inclusion of foreign substances, it is detrimental (**Awasthi *et al.*, 2014**).

Source: <https://link.springer.com>



A. Incidental/unknown adulteration

This kind of adulteration results from poor hygienic conditions for food and drink goods from the production site to the dining table. Since any substance other than its original is extraneous to the product, examples include residual pesticides from cans, rodent droppings, preservatives, mercury from effluents, lead from water etc., (Narayan, 2014) and Asrat and Yi. However, the ways the products are produced, handled, passed, processed, stored, transported and marketed may be the places where they were contaminated or adulterated (2014).

A. Food items and adulterants:

A variety of foods and beverages are vulnerable to adulteration. Finding food that is free from one or more adulterants, whether it is in the form of wheat, pulses, oil, fruits, vegetables, milk, sweets, spices, tea, coffee, honey, bakery goods, chocolate or fruit juice is challenging (Aladdin 2012). About 90% of unbranded, loose types of food such as cake used as a protein supplement for breastfeeding animals are contaminated. Food and beverage adulteration can be found in four main areas, including milk and milk products, fats and oils, food grains and others (items with both animal and plant origins) adulteration, respectively.

Results and Discussion:

Food item	Adulterant	Propose	Disease
Milk	Starch	To increase volume	Stamoch disorder
Ghee	Vanaspati	To increase the volume	Belly fat increase
Black pepper	Papaya seeds	To increase volume	Psychological disorder
Sugar	Chalk powder	To weight increase	Stomach disorder
Mustard seeds	Agremone seeds	To weight increase	Psychological disorder
Beverages	Metanil yellow	To develop colour	Carcinogenic
Bura sugar	Whashig soda	To increase weight	Stomach disorder
Wheat	Dhatura seeds	To increase weight	Psychological disorder
Rice	Boric acid	To preservation	Gastric problem
Milk	Formaldehyde	To preservation	Carcinogenic
Jaggery	Washing soda,	To preservation	Vomiting and other Stomach disorders
Honey	Molasses, dextrose, sugar and corn syrups	To preservation	Stomach disorders
Dal /pulses	Yellow colour	To develop colour	Carcinogenic
Chilies powder	Brick powder	To increase weight	Stomach disorder

1. Milk & Milk products adulteration

Milk adulteration entails both the addition of water and the removal of milk's healthy fats. Milk is preserved with several preservatives, including formalin and certain antibiotics, to lengthen its shelf life (Chanda *et al.*, 2012). Since fresh milk is pure and free of adulterants when it comes out of the udder, but can be contaminated by bacteria, yeast, fungi and dust(Dehinenet *et al.*, 2013) (Awan *et al.*, 2014).

Adulteration of Fats and Oils

Adulteration of edible oils and fats is a significant problem. The major reason for adulteration is deceit, which boosts their income by increasing its volume and prevents an unintentional quality check on dubious products (Pitts *et al.*, 2007). Food is frequently contaminated to satisfy the wants of an expanding population (Yadav, 2018).

Food grains adulteration:

Adding sand or crushed stone to cereal grains increases their weight, which is known as adulteration. The plastic beads are similar to grains in size and colour then combined with cereal grains and legumes. To make grains heavier, water is sometimes sprinkled on them.

2. Other Adulterations

Adulteration of other foods (foods made from animals or plants) is also common. Red chilli powder is frequently used with brick powder, and tea leaves are frequently combined with expired tea leaves. Honey adulteration with synthetic honey (based on C4 plant sugars) has increased.

3. Reasons for Food Adulteration

A technique used as part of a business strategy to achieve a trader's profit goal. A lack of effective government activities and a lack of food laws. Food demand has increased due to a population that is expanding quickly. Broad popular ignorance of and disregard for proper food consumption. To raise the amount of food production and sales in the face of food insecurity to make food appealing and a replica of a dish that is popular.

Controlling methods of Food Adulteration

1. Steps to consider when transporting and storing food products:

The major threat to food grains, legumes and spices is insect infestation brought on by the humid and unsanitary conditions of the warehouse. Extra care must be taken to avoid grain rotting during the rainy season and in places with high humidity. Create a warehouse with the correct storage conditions to reduce contamination risk.

2. Steps to consider while processing food products include:

It is best to prevent outbreaks of Salmonella, E. coli, and Campylobacter. Sanitation and cleaning standards must be met in the machinery's design. Spend money on pest identification and monitoring. To lessen the risk of contamination, it is important to prioritise safe waste disposal.

3. Steps to take care of while packaging food products:

With regard to allergen information, food goods should be appropriately labelled. Contamination by microbes and chemicals should be avoided during packaging. The ink that was used to print on the packaging shouldn't contain any hazardous substances. It is necessary to implement regulations governing food packaging. Maintaining a clean workplace should be the primary goal.

The health impacts of contaminated food:

We must have all noticed that compared to ten years ago, there are now more people raising concerns about food adulteration. The cause is straightforward: as working people with hectic lives, we are looking for quick fixes. People used to grind their own spices and grow vegetables in their courtyards back in the day, but who has time for that these days? Let's first understand the negative impacts of food adulteration before learning how to avoid it without interfering with our hectic routines.

4. Increase in the impurity of food

Food contamination tends to grow when it is adulterated. The limits for dangerous consumption increase as impurity levels climb. Although you might not notice the effects right away, adulteration is a long-term danger to our health. I would advise you to create your own goods, but if it is too much work, it is best to buy organic or from the farmers themselves.

5. Nutritional deficiency

Adulterated food is devoid of nutrients and tastes different from unadulterated food. We jeopardize both our taste senses and our health by eating tainted food. Fresh food has a quick and favorable impact on our health.

6. Causes a variety of diseases

Food adulteration has been connected to a number of chronic illnesses, including food poisoning, lathyrism, cancer, vomiting, dysentery, joint discomfort, and diseases of the liver, stomach, or joints. Numerous potential future health concerns are caused by the minerals, chemicals, and low-quality additives added to food goods. According to several studies, some contaminated food products can cause abortions or brain damage.

7. Effects of adulteration:

Because of issues with adulteration of the food products we consume on a regular basis are unsafe and unclean to use (**Asrat et al., 2012**). Food adulteration has emerged as a significant issue in recent years and eating such food increases the risk of major illnesses like cancer, diarrhea, asthma, and ulcers. Food adulteration affects producers and farmers, processors or manufacturers/enterprises, consumers and the government in general very seriously.

8. Effects on farmers and producers

The weakest link in the supply chain of an industry can be damaged by adulteration, which not only affects large corporations but also farmers or producers (**such as dairy, honey, coffee, wheat, etc.**). In the midst of the crisis, many farmers experienced significant losses, cost increases due to feed expenses, milk cow shortages brought on by mass sales or slaughter, as in the case of the China dairy scandal, and a lack of consumer interest in the produced (**Qian et al., 2011**).

9. Effects on consumers

Some of the harmful effects of food adulteration include diarrhea, stomach disorders, giddiness, joint pain, liver disorders, dropsy, gastrointestinal problems, respiratory distress, edema, cardiac arrest, glaucoma, eyesight problems, headaches, cancer, anemia, insomnia,

muscular paralysis, and brain damage. Fruits and vegetables contain a number of harmful compounds and colours **Anita and Neetu 2013**. Copper sulphate, mangoes, and bananas all contain calcium carbide. Oxytocin is a hormone that helps pumpkin, watermelon, brinjal, gourds, and cucumber grow.

Adulteration Issues:

The information and technology available are insufficient to identify phony and tampered goods. Frequently, the precise number of foreign suppliers of the products is unknown. Only a tiny percentage of facilities are actually inspected on the ground (**Dogarawa, 2013**), says Dogarawa. Adulteration of food products makes it less likely to be accepted in the market because consumers doubt its authenticity. Dairy products from the Wolaita and Kucha area command high prices because they are valued for their high quality **Asrat and Yilma (2014)**. Such behaviour as to be avoided because it may harm the reputation of the region's butter.

Conclusion

Without our knowledge, food adulteration may have a serious negative influence on health. If our culture adopts a few safety precautions, this can be avoided. Customers should be able to differentiate between good and terrible products. The quality of the food sold by both large and small stores should be inspected by government organizations.

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