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Adulteration of Cereals and Cereals Products

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ABSTRACT

The majority of the foods we consume are vulnerable to food fraud and adulteration. Food adulteration occurs when a non-food item is purposely added to increase the quantity of raw or cooked food, or when non-food substances are accidently added. Any dangerous or detrimental elements that may make the food harmful to one's health are also considered food adulteration. Food adulteration can take the form of an act of addition, the removal of a valuable food component, or the substitution of these important elements with less expensive (cheaper) ones in order to achieve an unfair economic advantage. This act of food fraud may result in a financial gain for the maker, but it results in a loss for the product's eventual customers. Consumers are affected in various ways when purchasing and serving adulterated foods; they may not receive the intended food nutrients, the adulterated meals may be harmful for health, and there may be a financial loss to the consumers. Milk, beef, injera in Ethiopia, honey, butter, juices, and other foods are examples of foods that are known to be prone to adulteration both in our country and around the world. In Ethiopia, there was a recent story in the media concerning injera being adulterated with saw dust. Adulteration of food can be detected using a variety of techniques. Physical, chemical, biological, and other procedures are among the techniques used. When both the adulterant and the food have a similar physiochemical makeup, detection of food adulterants becomes more challenging. Food adulteration infringes on consumers' right to eat safe, high-quality meals. As a result, all responsible persons, organizations, and governments, including the government, should perform their responsibilities to protect food adulteration and expose the recognized activities. Furthermore, researchers and academics working in various research institutes have several holes to fill relating to the problem, such as assessing the situation, identifying foods susceptible to adulteration in the context of the country, developing and validating detection technologies, and so on.

KEYWORDS – adulteration, cereal, Wheat, Rice, Maize, Jawar, Bajra, Chana, Barley

INTRODUCTION

A staple crop is a crop that is particularly vital to the world's diet. Any grass farmed for its grain is referred to as a cereal. Cereal is named after Ceres, the Roman goddess of agriculture. Cereal grains supply more energy for food than any other crop. Whole grain cereal grains are unprocessed cereal grains that are high in vitamins, minerals, carbs, lipids, oils, and protein.

Dieters are advised to eat only a limited amount of them each day due to their high energy level. Refining is the process of processing cereals. The bran and germ are removed from the grain during refinement, leaving a white material that is mainly carbohydrate. It's commonly referred to as flour, and it's used in everything from bread to pizza. Rice is frequently milled to remove its tough outer shell, although this reduces its nutritional value **(Archak, *et al.*, 2007)**.

The majority of the world's population eats cereal grains and their products as their primary source of nutrition. Natural cereals are high in vitamins, minerals, carbs, lipids, oils, and protein, among other nutrients. Because of the growing global population and the diverse applications of cereal products, such as the production of processed foods and beverages and the manufacture of adhesives, cosmetics, and detergents, unscrupulous producers and intermediaries have an opportunity to adulterate food products and increase their profit margin by adding low-grade or synthetic ingredients. Cereals are edible seeds or grains from the Gramineae grass family. Rye, oats, barley, maize, triticale, millet, and sorghum are among the grains farmed in many countries. Wheat and rice are the most significant crops on the planet, accounting for more than half of all cereal production. The embryo (or germ), which holds the genetic material for a new plant, and the endosperm, which is packed with starch grains, are structurally similar in all cereals. To avoid mould deterioration, pest infestation, and grain germination, proper grain storage is essential after harvest. If dry grains are stored for only a few months, only minor nutritional changes occur; however, if the grains are stored with more moisture, grain quality can degrade due to starch breakdown by grain and microbial amylases (enzymes) **(Diaz-Amigo, 2012)**.

Milling is the most common method for processing cereals, but a variety of other methods is also employed to create a variety of products. The various grains are milled in slightly different ways, but the process can be summarized as grinding, sifting, separation, and regrinding. The amount of the outer bran and aleuronic layers removed determines the final nutritious content of a cereal after milling, as this is where the fibre, vitamins, and minerals are concentrated. Pests, mycotoxins, rusts, and smuts have the potential to contaminate cereals and cereal products. Acryl amide (a potential carcinogen) has recently been discovered in starchy baked dishes. The UK Food Standards Agency has recommended the public not to change their diet or cooking methods because no link between acryl amide levels in food and cancer risk has been identified. However, the European Union's Scientific Committee on Food has accepted proposals made by the Food and Agriculture Organization/World Health Organization, which include looking into the possibility of lowering acryl amide levels in food by modifications in formulation and processing. Cereals have been consumed by humans for thousands of years **(Miller, 2001)**.

Cereals are staple meals in both industrialized and developing countries, and they are major sources of nutrients. Cereals and cereal products are good sources of energy, carbohydrate, protein, and fiber, as well as a variety of micronutrients such vitamin E, B vitamins, magnesium, and zinc. In the United Kingdom, cereals supply considerable levels of calcium and iron due to required fortification of some cereal products (for example, white flour and hence white bread) and voluntary fortification of others (for example, morning cereals). Bioactive compounds may be found in cereals and cereal products, and there is growing interest in the possible health benefits these substances may give. In this area, more research is needed, including the identification of additional compounds found in cereals and their bioavailability. Regular eating of cereals, particularly wholegrain cereals, may help to prevent chronic diseases like coronary heart disease, diabetes, and colon cancer, according to research. The exact methods by which grains have health-promoting effects are unknown. A number of characteristics, such as their micronutrient content, fiber content, and/or Glycaemic index, are likely to be implicated. Because wholegrain cereals may have a range of health benefits, increasing their intake appears to be a reasonable public health strategy. It could be helpful to have a quantifiable advice to enhance wholegrain food consumption. Furthermore, a greater variety of wholegrain foods that are quick and easy to prepare will encourage individuals to eat more of them. Manufacturers must continue to lower the sodium content of goods such as morning cereals and breads where possible, as cereal items now constitute a significant amount of the sodium intake of the UK population **(Bender & Bender, 1999)**.

There are several misconceptions about cereals and cereal products among the general public. To begin with, many more people believe they have a food intolerance or allergy to these items than research suggests, and cereals are viewed as "fattening" by some. The public should not be encouraged to cut out entire food groups unnecessarily, and because cereals and cereal products contain a variety of macro- and micronutrients as well as fiber, eliminating these foods without the support and advice of a registered dietician or other health professional could cause long-term problems. White flour in the UK could be fortified with folic acid (the synthetic form of the B vitamin folate) in the future to reduce the risk of neural tube abnormalities during pregnancy. Poor folate status is linked to excessive homocysteine levels, a growing risk factor for cardiovascular disease, thus such a shift could be beneficial for heart health as well. High folic acid intakes, on the other hand, might disguise vitamin B deficiency, a disorder that affects the peripheral nervous system and is increasingly common as people get older **(Minkkinen *et al.*, 2012)**.

Increased disease resistance in cereal crops can be achieved by manipulating the expression of native genes. Novel genes could be employed for this, as well as for generating herbicide-resistant crops and cereals with improved nutritional qualities, such as wheat (increased levels of iron in cereals and of beta-carotene in rice). Consumer acceptability and long-term ramifications of such breakthroughs must be examined, and consumer choice must be preserved. The understanding of the connections between human genes and foods is constantly expanding, and in the future, it may be feasible to focus specific nutrition instructions to people with specific genetic profiles **(Rodriguez-Saona and Allendorf, *et al.*, 2011)**.

Cereals are adulterated if:

- The cereal sold does not meet the nature of the substance or quality as per the demand of consumer.
- The cereal contains inferior or cheaper substance
- The cereal has been prepared, packed or kept under unclean conditions leading to contamination.
- Cereals contain a substance that depreciates or injuriously affects the health.
- If the cereal's original nature is substituted wholly or partially by abstracting a portion of vital substance from cereal.
- If it is an imitation of some other cereal substance

Causes of cereal adulteration:

- Profit motive of traders: Done as a part of the business strategy
- Food insecurity: To increase quantity of food production and sales.
- Increased Urbanization: To make maximum profit from cereal items by fewer investments.
- High population demands: Increased cereal demand of the population and its changing trends.
- Lack of consciousness of proper cereal consumption.
- Lack of effective cereal laws
- Lack of government in initiative

Methods of cereal adulteration:

I. **Mixing:** Mixing of clay, stones, pebbles, sand, etc.
II. **Substitution:** Cheaper and inferior substances being replaced wholly or partially with good ones.
III. **Concealing quality:** Trying to hide the food standard. E.G. adding captions of qualitative food to low quality for selling.
IV. **Decomposed cereal:** Mainly in fruits and vegetables. The decomposed ones are mixed with good ones
V. **Misbranding/ False labels:** Includes duplicate cereals, changing of manufacture and expiry dates.
VI. **Addition of toxicants:** adding non-edible substances like low quality preservatives, colouring agents, etc.

List of adulterant in cereals:

Table: 1 List of adulterant in cereals

Food Articles	Adulterants	Method for Detection	Remarks
Wheat, Rice, Maize, Jawar, Bajra, Chana, Barley etc.	Dust, pebble, Stone, Straw, weed seeds, damaged grain, weevil led grain, insects, hair and excreta of rodent	These may be examined visually to see foreign matter, damaged grains, discoloured grains, insect, rodent contamination etc.	Damaged/discoloured grains should be as low as possible since they may be affected by fungal toxins, argemone seeds, Dhatura seeds etc. In moderately excessive amount can result in risk to health, Discard the damaged undesirable grains before use

Nature of Adulteration

The majority of adulterants have a similar appearance to the original product and are indistinguishable when mixed. Sudan I–IV dyes, for example, are added to food goods to enhance or change their color and make them more appealing to potential customers.

Parboiled rice was the cereal examined, and cereal products included parched rice, rice flour, wheat flour, and maida. Parboiled rice and parched rice samples were found to be free of the adulterants tested for using boric acid, metanil yellow, and urea. Rice flour obtained from various outlets was tested for typical cereal flour adulterants such as chalk powder and boric acid, and both were determined to be missing. Adulterants such as boric acid, metanil yellow, and urea were not found in maida samples. Sand and bran were found in a sample of wheat flour from a coastal area supply. Wheat flour samples from both the coastal and urban areas were found to be contaminated with only the bran. Adulterants were not found in any of the other cereals or cereal products.

According to several accounts, certain substances can be effectively integrated into food products up to a large proportion while being undetectable by physical means or conventional methods. In terms of color, texture, flavor, and overall acceptability, the resulting food products are comparable to or better than the original products. Another type of adulteration is the inclusion of mistakenly added indirect additives such as insects and/or bone fragments, husks, and sand in grain products. Some insect pests attack grain kernels before or after harvest, and most of them go undetected during processing.

All adulterants degrade the final product's quality and frequently compromise the original food's integrity. As a result, trustworthy tests and analyses are required for quality control, customer protection, and, ultimately, business optimization.

Dal

Tur (arhal) dal is the most generally adulterated dal, and it is usually adulterated with metanil yellow. Metanil yellow is a common non-permitted food color used widely in India. Long-term ingestion of metanil yellow produces neurotoxicity in the developing and adult brain.

When natural or manmade hazardous substances are exposed to the nervous system, the normal action of the nervous system is disrupted, resulting in nerve tissue injury.

In dal, metanil yellow is used as a coloring adulterant. Its presence in dal can be determined by adding a few drops of HCl to a test sample; if the solution becomes pink, metanil yellow is present **(Arvanitoyannis and Tserkezou, 2011)**.

Adulterants in cereals

Sudan I dye

Sudan I dye is carcinogenic and geotaxic, making it illegal to use as a food coloring. Sudan I dye is a red-colored synthetic dye that has traditionally been used to color plastics and textiles. However, due of its

appealing hue, availability, and low cost, it has recently been used as a food colorant, particularly for culinary spices.

Lard

Lard is commonly found in cake product formulations, especially for animal feed, and is associated with health risks such as hypercholesterolemia and coronary disease.

Melamine

Melamine, which has a nitrogen bond comparable to that of natural proteins, is commonly used as a protein booster. Foods contaminated with melamine, such as wheat and soya beans, represent a serious threat to human and animal health.

Natural adulterants

There are two types of edible wheat: durum wheat and bread wheat. Because these two types have varied physical, chemical, and nutritional qualities, they have differing commercial values. To boost bulk and profit margins, high-quality durum wheat is frequently mixed with cheaper, lower-quality bread wheat.

Others

The negative effects of adulteration require consumers to be cautious about the commercially available products. However, consumer cautiousness is often insufficient to prevent the purchase and consumption of adulterated products because they do not have the resources (technical knowledge and equipment) to ascertain product authenticity. An organization for standards or an authentication authority for each geographical area must take responsibility on behalf of the public to test and analyze the authenticity of the food products presented to the consumers.

Prevention

Prevention is the greatest method to avoid these health issues. We can take a number of steps to assure this. We can start by looking at where we get our food ingredients, for example, is it from a reputable shop or merchant, which we should investigate. We also need to see if these establishments are inspected by food inspectors on a regular basis and if the facilities are kept clean and free of bugs. We must inspect the package, as well as the expiration date and the product's origin. It's also important to check in with the local community on a frequent basis to see whether individuals are becoming sick after eating at a particular restaurant or purchasing food items from a particular merchant. We should also raise public knowledge about the dangers of food adulteration in the local community so that when it occurs, people know where to go for help. We must keep in mind that contamination can occur in very small levels over time, and it may be hard to identify or intervene before it is too late. As a result, it is prudent that each of us takes a keen interest in this issue and educates our family, friends, and coworkers about the danger.

Conclusion:

Food fraud and adulteration affect the majority of the foods we consume. When a non-food item is purposefully added to increase the quantity of raw or cooked food, or when non-food items are accidentally introduced, food adulteration occurs. Food adulteration includes any risky or toxic ingredients that may render the food injurious to one's health. To gain an unfair economic advantage, food adulteration can take the shape of an act of addition, the removal of a valued food component, or the substitution of these significant parts with less expensive (cheaper) ones. This act of food fraud may benefit the creator financially, but it is a loss for the product's future customers. When consumers purchase and serve contaminated foods, they may not receive the desired food nutrients, the adulterated meals may be damaging to their health, and the consumers may suffer financial losses. Milk, meat, Ethiopian injera, honey, butter, juices, and other items have all been documented to be prone to adulteration in our country and around the world. In Ethiopia, there was a recent news article about injera being contaminated with saw dust. A variety of approaches can be used to detect food adulteration. Techniques employed include physical, chemical, biological, and other methods. Food adulterants are more difficult to detect when the adulterant and the food have comparable physiochemical makeups. Consumers' right to eat safe, high-quality meals is violated by food adulteration. As a result, all responsible individuals, organizations, and governments, including the government, should carry out their obligations to protect food adulteration and

reveal known activities. Furthermore, researchers and academics working in various research institutes have a number of gaps to fill in regards to the problem, including assessing the situation, identifying foods susceptible to adulteration in the context of the country, developing and validating detection technologies, and so on.

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