

Food adulteration affecting the nutrition and health of human beings

Shakuntala Srivastava*

Indira Gandhi National Open University

Received 21 December 2015; Accepted 28 December 2015; Available online 31 December 2015

Copyright: © 2015 Srivastava. This is an open access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Abstract

For a healthy body, a balanced diet is required which is obtained from good nutrition through food products. These days, many people malpractice the adulteration of food products to gain profit in an illegal way and earn money by deceiving the consumers. But, the adulteration of food is an emerging problem of concern which affects human health directly. There are a bundle of food adulterants which pose harmful effects to human health, hence it is necessary for mankind to overcome this malpractice. In the present review, we will discuss about some of the food adulterants causing serious health concerns to human beings.

Keywords: Food products; Food adulteration; Nutrition; Human Health

Introduction

Foods provide nutrients to our body which play a pivotal role in body growth, development and maintenance (Floros et al. 2010; WHO 1990). When the food products are impure or mixed or adulterated, they provide poor nutrition to our body and hence affect our body in many ways (Jacob 1976). To understand what adulteration is, one should first define the word "Adulteration" which is a legal term which denotes to a food product that fails to meet federal or state standards and usually refers to noncompliance with health or safety standards as determined by the Food and Drug Administration (FDA 1995, 2000) and the U.S. Department of Agriculture/ Food Safety and Inspection Service (USDA/FSIS 1999). Adulteration is defined as an addition of different substance to a food product in

order to increase the quantity of that food product either in its raw form or prepared form, which may result in the loss of actual quality of food item (Frank et al. 2003).

The addition or mixing of inferior, harmful, substandard, useless or unnecessary substances to foods that spoils the nature and quality of food items is considered as food adulteration (Khanna et al. 1989; Das et al. 1995). However, the Ministry of Health and Family Welfare is responsible for providing safe food to citizens and to assure the quality of food products, the Prevention of Food Adulteration Act, 1954 was set up that arranged the guidelines to provide pure and wholesome foods to consumers. The Act was last amended in 1986 to make punishments more stringent and to empower consumers further.

* Corresponding author

Email address: shagunchitransi@gmail.com (Dr. Shakuntala Srivastava)

Forms of food adulteration

Food can be adulterated in two ways, either “intentionally” or “unintentionally” (Bansal et al. 2015). The intentional food adulteration involves the substances added in food to improve appearance, flavor, texture or storage properties and broadly identified as food additives (Misra 1992; Gupta and Panchal 2009). While the unintentionally food adulteration involves the use of pesticides, growth promoters, components of packaging materials, solvents and enzymes used in food processing etc. (Bansal et al. 2015). In this category falls the pesticides which are used to protect the crops from insect-pests and by increasing the yield; fertilizers used to provide nutrition to plant and increase production (FAO/WHO 1986). However, it should be noted that pesticides are toxic substance and may pose variety of adverse effects if used indiscriminately (USEPA 2007). Another form of food adulteration is metallic contamination which includes the addition of some heavy metals such as arsenic from pesticides, lead from water, mercury, cadmium, and chromium from industrial effluents or from chemical industries, tins from cans

(<http://www.indiaagronet.com/indiaagronet/foods%20technology/food%20adulteration.htm>).

There are different forms of adulteration according to the nature or physical properties of the food adulterant. These can be categorized into-

- (i) **Separable-** The physical mixing of adulterants or addition of particles which can be separable or weeded out after detection.
- (ii) **Inseparable-** The physical mixing of adulterants or addition of liquids which cannot be separated out or in broader

terms which are inseparable after detection.

There are several types of food adulteration which are in practice in India as well as abroad, and in the present mini-review we will discuss about some of these as follows-

1. Adulteration of Milk, Fats and Oils

India has a good source of dairy production and hence large quantities of milk is adulterated which involves adding water to milk and removing the beneficial fats from milk (Gulati 1999). Additionally and often the soya milk, starch, groundnut milk, and wheat flour are also added to milk which makes the milk less nutritious and for the consumer (Borkova and Snaselova 2005). In a study conducted in different states of India during 2012, it was confirmed that milk was adulterated with detergent, fat, and even urea, and diluted with water and just 31.5% of samples conformed to FSSAI standards (FSSAI 2012). Adulteration of oils and fats is easily practiced but its detection is difficult because Ghee is often mixed with hydrogenated oils and animal fats, synthetic colors and flavors are also added to other fats to make them appear like ghee.

2. Adulteration of Cereals

The adulteration of cereals involves the mixing of sand or crushed stones and water sprayed on grains to increase the weight food grain. Cereal grains and pulses are mixed with plastic beads that resemble grains in colour and size (Babu and Shenolikar 1995).

3. Adulteration of fruits, vegetable, fishes

Adulteration of fruits, particularly mangoes, involves the use of artificial ripening agents and these fruits are being ripened with

calcium carbide; there are reports of fish being made to appear fresh with formalin. There are reports that injectable dyes are used as adulterants in watermelon, peas, capsicum, brinjal, papaya seeds in black pepper to enhance their flavor and colour (Babu and Shenolikar 1995). These adulterants such as calcium carbide and formalin are banned from use in food items ever since they have been known to be toxic and even been classified as carcinogens or cancer causing substances.

4. Some other common food Adulterations

There is a long list of food adulterants used in our daily intake of food items. Such as chilli powder which is often mixed with brick powder, while tea leaves are frequently mixed with used tea leaves, vanaspati used as an adulterant for ghee, ergot used as an adulterant for cereals, chalk-powder is used as an adulterant for flour, chicory used as an adulterant for coffee, papaya seeds is used as an adulterant for pepper, tamarind seed powder used as an adulterant for coffee, wood powder is adulterated for turmeric and dhaniya powder (Lakshmi et al. 2012). The bright colors used to attract children in different forms of candies often contained lead, copper or mercury salts (Babu and Shenolikar 1995). On the other hand, some food-preservatives are used extensive, which often constitutes adulteration, for example salt but it is rarely classified as an adulterant. Meanwhile, others preservatives include the

use of salicylic, benzoic, and boric acids, along with their sodium salts, formaldehyde, ammonium fluoride, sulphurous acid and its salts (Awasthi et al. 2014). The continued use of food preserved by these agents may be injurious when used for long period.

Effects of adulteration on humans

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 result into paralysis of the limbs. Another adverse effect of food adulteration is metanil yellow used to brighten the color of pulses, turmeric powder and sweet meats is a coal-tar dye, which may cause cancer. Some people may experience intestinal disorders after regular use of powdered sugar and other food items being adulterated with washing soda (Thakur et al. 2009). These food adulterations incidents are very harmful to the humans and they should be seriously dealt in by both the consumer organizations and consumers (Swami 1990).

A list of different food items being adulterated and their health perils on human beings is presented in Table 1.

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

Food Products	Respective Food adulterants	Health hazards in humans
Milk	Water, starch, urea, extraction of fat	Digestive system disorders
Sugar	Chalk powder	Stomach infections
Tea	Artificial pigments/dye, already used leaves, iron fillings	Liver disorders, cancer
Coffee Powder	Tamarind and date seed powder, saw dust	Diarrhea
Salt	White powder, stone, rawa	Stomach disorders
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, Cardiac arrest
Black pepper	Dried papaya seeds	Injurious to health
Pulses	Kesari dal, Metanil Yellow, clay, stone, gravel	Lathyrism, carcinogenesis, stomach disorders
Butter	Oleo, 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, soapstone bits, sand, Ergot	Poisonous due to poisonous compound in the fungus Ergot
Green chillies/ green peas	Malachite green	Cancer, genetic mutations, harm the human reproductive system
Vegetable Oil	Argemone and mineral oil	Heart diseases, skin infection and cancer
Ghee	Ghee essence, vanaspati, sweet potato, mashed-potato and other starches of edible oils	Cancer, acute renal failure
Carbonic drinks	Aluminium leaves	Asthma, lung disorder
Ice-creams	Detergent powders	Skin and lung diseases
Sea food	Mercury, Arsenic	Stomach and brain disorder

*(Adapted from Bansal et al. 2015 and other published resources cited in this paper)

Conclusion

Food adulteration is a great cause of concern as it affects human health directly. As it is already discussed about the different food adulterations and their adverse effects in the present mini-review, this malevolence should

be removed from our country for our better living. Henceforth, there is a critical need of stringent regulation and applicability of strict rules for production of better food quality products to the consumers of India.

Conflict of Interest

All contributing authors declare no conflicts of interest.

Acknowledgments

This work was supported by Indira Gandhi National Open University. The author would like to thank Editor-in-Chief and Associate Editor, Journal of Biological Sciences and Medicine for accepting and refinement of this article for the publication.

References

- Awasthi S, Jain K, Das A, Alam R, Surti G, Kishan N (2014) Analysis of Food quality and Food Adulterants from Different Departmental & Local Grocery Stores by Qualitative Analysis for Food Safety. *J Env Sci Toxicol Food Technol* 8 (2): 22-26
- Babu S, Shenolikar IS (1995) Health and nutritional implications of food colours. *Ind J of Med Res* 102: 245-249
- Bansal S, Singha A, Mangal M, Mangal AK, Kumard S (2015) Food Adulteration: Sources, Health Risks and Detection Methods. *Critical Rev Food Sci Nut.* DOI:10.1080/10408398.2014.967834
- Borkova M, Snaselova J (2005) Possibilities of different animal milk detection in milk and dairy products – a review. *Czech J Food Sci* 23: 41–50
- Das A, Gupta P, Banerjee A (1995) Text Book of Home Science. 1st edition New Delhi: Arya Book Depot, pp 125-136
- FAO/WHO (1986) Joint FAO/WHO Food Standards programme, Codex maximum limits for pesticide residue. Vol XIII, 2nd ed. Rome Italy
- FDA (1995) Food and Drug Administration, Center for Food Safety and Applied Nutrition. Defect Action Level Handbook. Washington, DC Government Printing Office, Revised 1997, 1998
- FDA (2000) Food and Drug Administration Action Levels for Poisonous or Deleterious Substances in Human Food and Animal Feed. Washington, DC Government Printing Office
- Floros JD, Newsome R, Fisher W, Barbosa-Canovas GV, Chen H, Dunne CP, German JB, Hall RL, Heldman DR, Karwe MV, Knabel SJ, Labuza TP, Lund DB, Newell-McGloughlin M, Robinson JL, Sebranek JG, Shewfelt RL, Tracy WF, Weaver CM, Ziegler GR (2010) Feeding the World Today and Tomorrow: The Importance of Food Science and Technology. *Comp Rev Food Sci Food Safety* 9: 572–599
- Frank, Richard L, Hahn, Robert A (2003) Adulteration of Food." *Encyclopedia of Food and Culture.* Encyclopedia.com. <http://www.encyclopedia.com>
- FSSAI (2012) Food Safety Standards Authority of India, Government of India. Retrieved 2 April 2012
- Gulati V (1999) Is the milk you drink safe from [Http://www.TribuneIndia.com/99aug22/str3.htm](http://www.TribuneIndia.com/99aug22/str3.htm)
- Gupta N and Panchal P (2009) Extent of Awareness and Food Adulteration Detection in Selected Food Items Purchased by Home Makers. *Pakistan J Nut* 8 (5): 660-667
- Jacob T (1976) Food adulteration. Macmillan Company India
- Khanna SK, Upreti KK, Singh GB (1989) A comparative study on pattern and magnitude of adulteration if food stuffs two decennial survey terms. *Ind J of Nut Diet* 24 (10): 310-318
- Lakshmi V et al. (2012) Food Adulteration. *IJSIT* 1(2): 106-113
- Thakur M, Walia I, Singh A (2009) Impact of health education package on knowledge and practices of women regarding food adulteration. *Nurs Mid Res J* 5(1): 1-9
- Misra RC (1992) A consumer guide to food additives. *Standard India* 5 (3): 421-427
- Prevention of Food Adulteration, Act 1954
- Ram MD, Gopal K, Sharma B (1993) Adulteration of food and human health. *Swasth Hind*, pp 249-240
- Swami SN (1990) Consumer movement for quality food. *Social Welfare* 37 (7): 9-10

- Sharma BK, Singh S, Kumar R, Gupta A, Bambery P (1992) Epidemic Dropsy. PGI Bulletin 32 (4): 130-131
- USDA/FSIS (1999) Final Rule-Performance Standards for the Production of Certain Meat and Poultry Products. Federal Register 64 (3):732-749
- USEPA (2007) US Environmental Protection Agency What is a pesticide? epa. gov. Retrieved on July 24, 2007
- WHO (1990) Public Health Impact of Pesticide Use in Agriculture. World Health Organization, Geneva