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RESEARCH ARTICLE

FOOD ADULTERATION: AN EMERGING THREAT TO HUMAN HEALTH IN INDIA

[1,*]Hiralal Jana and [2]Debabrata Basu

[1]Department of Agricultural Extension, College of Agriculture, Bidhan Chandra Krishi Viswavidyalaya, Agricultural Farm-713101; Burdwan, West Bengal, India
[2]Department of Agricultural Extension, Faculty of Agriculture, BCKV, Mohanpur-741252, Nadia, West Bengal, India

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**Corresponding author: Hiralal Jana*

ABSTRACT

Adulteration and contamination are encountered in food consumed at the household level of India, in the food service establishments and business firms, and also when sold as street foods. Non-permitted colors are the most common additives to foods. Contamination of mycotoxins, metals and pesticides in daily foods and milk has been found highly toxic and carcinogenic, and about 70% of deaths are supposed to be of food-borne origin. Food safety measures are emphasized with an objective of prevention of health hazards and strengthening of regulatory system. It is possible to prevent food adulteration and contamination if people are made aware of health hazards. If food inspectors are vigilant and active, the risk of food toxicity can be minimized at all levels of food supply and consumption. Further, simple measures can prevent further complications, particularly those caused by microbiological contaminants. Fatal diseases and health hazards prevalent in India can be minimized and consumers can live happily with good health. The social life in the communities is strengthened resulting in less expense on health related problems. Citizens aware of food adulteration and contamination can arrange camps/campaigns through local bodies and safe food can be the goal for all concerned.

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INTRODUCTION

Pure, fresh and healthy diet is most essential for the health of the people. Food is one of the basic necessities for sustenance of life. It is no wonder to say that community health is national health. Food adulteration has become rampant in India. Food adulteration is the addition or subtraction of any substance to or from food, so that the natural composition and quality of food substance is affected. Food adulteration can be intentional when done to add volume, texture, taste or stability to the items, or it can be due to carelessness or poor maintenance of the facility/logistics on part of the food manufacturer/ distributor. The bottom line is that it can cause serious long term damage to human health. Food adulteration is the process in which the quality of food is lowered either by the addition of inferior quality material or by extraction of valuable ingredient. Nutritious substances which are added intentionally to food are generally in small quantity to improve its appearance, flavor, texture or storage properties. Adulteration is a legal term meaning that a food product fails to meet federal or state standards. The word is proper only when the additions are unwanted by the consumer. An adulterant is a pejorative term for a substance found within other substances such as food, fuels or chemicals even though it is not allowed for legal or other reasons. Adulterants when used in illicit drugs are called cutting agents, while deliberate addition of toxic adulterants to food or other products for human consumption is known as poisoning.

Government uses to declare an adulterated food: Following are the points which government uses to declare an adulterated food.

- A substance is added which depreciates or injuriously affects it.
- Cheaper or inferior substances are substituted wholly or in part.
- Any valuable or necessary constituent has been wholly or in part abstracted.
- It is an imitation.
- It is coloured or otherwise treated, to improve its appearance or if it contains any added substance injurious to health.
- For whatever reasons its quality is below the standard.

Reasons for food adulteration

- To increase the weight
- To get more profit

- To increase volume of trade by showing lower prices
- Rising population
- Lack of effective coordination
- Lack of proper food laws
- Lack of government initiatives
- Politicians are not raising their voices

Bad effects of pesticides: Dangerous levels of pesticide residues have been found in many main vegetables like cauliflower, cabbage, small red onions, curry leaves, green chillies, etc. About three years ago, Profenofos, which is a second-level pesticide, was banned in India, except for tea and cotton. But its residues have been found in vegetables like gooseberries, green chilli, okra, curry leaves, mint leaves and coriander leaves. Consuming pesticide-laden fruits and vegetables for a long period of time can prove fatal. Health experts say that pesticides are neurotoxins, affecting the nervous system and other important organs such as liver and kidney. Food poisoning and different sorts of allergies are common from these pesticides. Some pesticides even lead to cancer. Certain pesticides cause skin problems, loss of weight, sleeplessness and irritability.

Various crops and their pesticides level:-More or less, every crop is affected by pesticides' application. Here are the few crops those are indicated:- (a)Brinjal: Chemical found is Heptachlor, 860% above the legal limit (b) Cabbage: Chemical found is Cypermethrin, 95.5% above the legal limit (c) Okra: Chemical found is Heptachlor, 55% above the legal limit (d) Rice: Chemical found is Chlorfenvinfos, 1324% above the legal limit (e) Banana: Chemical found is Chlorodane, 54% above the legal limit (f) Cauliflower: Chemical found is Aldrin, 320% above the legal limit (g) Apple: Chemical found is Dichlorvas, 140% above the legal limit

Food adulteration situation in various states:- States in India show contamination in water & milk:-In water, Chandigarh showed 100 per cent adulteration, Jharkhand 75 per cent, Andhra Pradesh 70 per cent, Karnataka 66 per cent and Tamil Nadu 58 per cent out of the samples collected for testing from each state or union territory. Many states, which had showed considerable levels of adulteration in bottled water in the previous financial year, have not given their data for this year. Gujarat at 40 per cent, Haryana 30 per cent and Uttar Pradesh at 28 per cent contamination last year, are among the states with no data for 2014-15, as per Parliament reply given on July 24. In milk too, there are many absentees in 2014-15 including Gujarat, Delhi, West Bengal, Haryana, Punjab, Rajasthan and Uttar Pradesh, with these states offering no data. Himachal Pradesh showed 92 per cent of its milk samples being contaminated, while others with high level of adulteration were Jharkhand at 45 per cent, Chhattisgarh at 38 per cent, Jammu & Kashmir at 32 per cent and Madhya Pradesh at 28 per cent. One-fifth of food items in the market, tested by government labs in the year 2012, were either substandard or adulterated, records of the health and family welfare ministry have revealed.

Food adulteration method: - What way food adulteration is done, here are the few examples, it is just tip of iceberg: If after reading the above, you go back to leading your usual life, then do not blame the adulterer for his criminal act on your near and dear ones. We are allowing him to get away with it. About 40 per cent of food items are adulterated.

Identification of adulterated food:-There is a good chance that a lot of what we eat is adulterated. While it might be difficult to detect with regards to packaged foods, there are certain everyday foods you can cross-check. FSSAI has put together a list of foods that we frequently consume and how to spot if any of them have been tampered with or adulterated.

Milk: Milk is possibly one of the easiest targets and that's why we'll find hundreds of cases where food authorities or independent food testing agencies have found milk to be adulterated. A 2014 report warned users of how the milk produced by Indian cows might be adulterated because they graze on garbage. A 2012 study conducted by the Food Safety and Standards Association of India (FSSAI) across 33 states found that milk in India was adulterated with diluted water, detergent, fat and even urea. How to check if your milk is adulterated: Put a drop of milk on a polished slanting surface. If it flows leaving a white trail behind, then it's pure but if it flows without leaving a mark then it's adulterated. To make sure that the milk we're having isn't synthetic, pay attention to its taste. Synthetic milk has a bitter, almost soapy aftertaste and turns yellow on heating.

Coconut Oil: How to check if it's adulterated: Place the bottle or container of coconut oil in the fridge. The oil will freeze and leave the adulterant as a separate layer.

Honey: The Journal of Food Science suggests, "Olive oil, milk, honey, saffron, orange juice, coffee and apple juice are the seven most likely food ingredients to be targets for intentional or economically motivated adulteration of food." How to check if honey is adulterated: Honey is often adulterated with water to increase the bottle's quantity. The best way to ensure that's not the case, dip a cotton wick in pure honey and light it with a matchstick. If there is water in the jar it won't allow the honey to burn.

Chilli: Chilli powder is often adulterated with a similar looking substance like brick powder. To find out if yours is too, take a teaspoon of chilli powder and stir it into a glass of water. If the water changes colour to something red and earthy then you know your powder was adulterated.

Cumin Seeds: How to check if it's adulterated: Rub the cumin seeds in the palm of your hand. If they rub off a black colour then they've been coloured and are adulterated.

Green Chilli: Those gorgeous green chillies that turn the heat up in your dishes may not actually be that green. So if you'd like to make sure they are, then take a piece of cotton soaked in liquid paraffin and rub a small portion of the chilli. If the piece of cotton picks up any colour, then the chillis are adulterated.

Tea Leaves: Tea leaves are often adulterated with chemicals and additives that add to its aroma or flavour. But the most common kind is colour and here's how you can spot it. Take a filter paper and spread a few tea leaves on it. Sprinkle some water over the filter. If there is any colour present in the leaves then it'll stain the paper. Now wash the filter paper under tap water and carefully look for stains against the light. It is debatable, the extent to which we can check food for adulteration. But we can do our part to make sure that what we're eating or feeding our families is safe and pure.

Table 1. Common adulterants in food

Sl.	Items	Adulterants
1	Butter and Cream	Anatta is added to give a yellow tinge to butter. A byproduct of beef fat called oleomargarine is added in large quantities to butter. Cream is adulterated with gelatin and formaldehyde is added to increase the shelf life. Vanaspati is added to pure ghee and butter.
2	Ice Cream	Washing powder is regularly added to add volume to ice cream.
3	Milk, Paneer, Khoya	Urea, Starch and washing powder is added.
4	Tumeric, Coriander powder, Red Chilies	Tumeric is mixed with metanil yellow, colored chalk powder, aniline dyes; wood powder is added to both turmeric and coriander, while red chilies is mixed with red color dye, Sudan red III color and brick dust.
5	Mustard	Argemone seeds are regularly added.
6	Spice Powder	Barn is added along with synthetic colors.
7	Cinnamon Bark	Cassia bark is added.
8	Cumin seeds	Grass seeds colored with charcoal are mixed.
9	Pulses: Moong, Chana etc	Lead Chromate is added on a regular basis. Kesari dal is added to Besan and yellow dal.
10	Tea	Iron filings, colored tea leaves, used.
11	Coffee	Chicory is mixed with the powder.
12	Wheat Flour	Chalk powder, barn dust and sand is added.
13	Confectionary	Colours that have a harmful effect on the body are added to confectionary items that children consume on a regular basis and they include copper, Prussian blue, arsenic compounds, chrome yellow etc.
14	Vegetables	Copper salts are added to color the vegetables with green.
15	Vegetable Oils	Castor oil, Mineral oil, Argemone oil, Kranaja oil is added.

Govt. efforts to prevent food adulteration: Food Adulteration is a serious problem in India & laws have enacted by govt. to tackle the problem. Adulterating the quality of food to increase its longevity and taste in order to increase profit comes at the heavy cost of health of the millions consuming it, jeopardizing the future of the country by making available noxious consumables to the younger generation. Humans have adulterated food to increase its longevity or to improve its taste since pre historic times. In ancient Rome and Greece, wine was often mixed with honey, herbs, spices and even saltwater, chalk or lead, which served as both a sweetener and a preservative. In middle ages, adulteration of food began for profit purposes, traders mixed spices with cheap substitutes. By the end of the 19th century, the rise of analytic chemistry enabled manufacturers to mask food deterioration in ways that were tough to detect. At the same time, home grown elixirs, tinctures and “medicines” containing opium, cocaine, heroin and other drugs were sold without restriction, warnings or ingredient labels. Adulterated food has direct consequences on the health of the consumers. As processed foods with multiple ingredients are increasingly sourced from numerous countries and the supply chain has become more complex, tracing the sources of contamination—intentional or not—has become a significant challenge.

A Criminal Offence: The Indian Penal code, 1860, lays down certain provisions criminalising the act of adulterating food items and also selling of consumables unfit or noxious for consumption. Sections with regard to food safety are:

- **Section 272**- Whoever adulterates any article of food or drink, so as to make such article noxious as food or drink, intending to sell such article as food or drink, or knowing in to be likely that the same will be sold as food or drink, shall be punished with imprisonment of either description for a term which may extend to six months, or with fine which may extend to one thousand rupees, or with both.
- **Section 273**- Sale of noxious food or drink- Whoever sells, or offers of exposes for sale, as food or drink, and article which has been rendered of has become noxious, or is in a state unfit for food or drink, knowing or having reason to believe that the same is noxious as food or drink, shall be punished with imprisonment of either description for a term which may extend to six months, of with fine which may extend to one thousand rupees, or with both.

Domestic Legislations: To curb the problem of adulteration, first, it was necessary to lay down concrete definition of what comprises of adulterated food. This happened, for the first time, in 1938. The Federal Food, Drug, and Cosmetic (FD&C) Act (1938) provided that food is "adulterated" if it meets any one of the following criteria:-

- It bears or contains any "poisonous or deleterious substance" which may render it injurious to health;
- It bears or contains any *added* poisonous or *added* deleterious substance (other than a pesticide residue, food additive, color additive, or new animal drug, which are covered by separate provisions) that is unsafe;
- It s container is composed, in whole or in part, of any poisonous or deleterious substance which may render the contents injurious to health; or
- It bears or contains a pesticide chemical residue that is unsafe. Food also meets the definition of adulteration if:
- It is, or it bears or contains, an unsafe food additive;
- It is, or it bears or contains, an unsafe new animal drug;
- It is, or it bears or contains, an unsafe color additive;
- It consists, in whole or in part, of "any filthy, putrid, or decomposed substance" or is otherwise unfit for food; or
- it has been prepared, packed, or held under unsanitary conditions (insect, rodent, or bird infestation) whereby it may have become contaminated with filth or rendered injurious to health.

As per the latest reports, some of the most commonly occurring heavy metals in our daily foods are cadmium, lead, arsenic and mercury. All of these lead to serious health implications, primarily causing damage to healthy tissue

Prevention of Food Adulteration Act, 1954: The Government of India brought a comprehensive and consolidated legislation in the form of the Prevention of Food Adulteration Act, 1954, to curb the predicament of Food

Adulteration. The punishments for the offenses in 1954 Act were set out and every once in a while, considering the gravity of the issue, fitting authoritative revisions were made and the offenses were classified culpable with discipline broadening upto life imprisonment.

The Food Safety and Standards Act (FSSA), 2006: The Food Safety and Standards Act (FSSA), 2006, which repealed the above specified legislation, provides for penalties in case of any non compliance. Generally, non-compliance with various provisions of the FSSA may attract penalty of up to Two Lakh Rupees. However, under Section 63, it provides that if any person or food business operator himself or by any person on his behalf who is required to obtain license, manufacturers, sells, stores or distributes or imports any article of food without license, shall be punishable with imprisonment for a term which may extend to six months and also with a fine which may extend to Five Lakh Rupees. In India Prevention of Food Adulteration Programme has been developed to ensure safe food for the consumers. The ministry of health and family welfare in India ensures that consumer get safe food. The legislation called "Prevention of Food Adulteration Act, 1954" was drafted for this purpose.

The first law to regulate the quality of food was made in the country 1899. Up till 1954 the states made their own food laws and there were substantial differences in the rules and specification of food. A legislation called prevention of food adulteration act (PFA) was endorsed in the year 1954 for making uniformity in food laws all over India. The major role of central government is as an advisory in its implementation. Food laws and standards adulteration of food stuff was so rampant, widespread and persistent that nothing sort of a somewhat drastic remedy in the form of a comprehensive legislation became the need of the hour. To check this kind of anti social evil a concerted and determined onslaught was launched by the government by introduction of the PREVENTION OF FOOD ADULTERRATION BILL in the parliament to herald an era of much needed hope of consumers at large, adulteration of food stuffs and other goods is now included in the concurrent list (iii) in the constitution of India, it has, therefore, become possible for the central government to enact an all India legislation on this subject, the bill replaces all local food adulteration laws where they exist and also applies to those states where there are no local laws on the subject. The Prevention of Food Adulteration Bill was passed by both the house of parliament and received the assent of the president on 29 September 1954. It came into force on 1st June 1955 as THE PREVENTION OF FOOD ADULTERATION ACT, 1954.

List of adaptation order and amending acts: - (1) The adaptation of laws (no 3) order, 1956 (2) The prevention of food adulteration (amendment) act, 1964 (3) The prevention of food adulteration (amendment) act, 1971 (4) The prevention of food adulteration (amendment) act, 1976 (5) The prevention of food adulteration (amendment) act, 1986. Standards are laid for vegetable and fruit products, spices and condiments, animal products and processed foods. The products are checked for quality by the Indian Standards Institution (ISI) in their own network of testing laboratories at Delhi, Bombay, Calcutta, Madras, Chandigarh and Patna or in a number of public and private laboratories recognized by them. The AGMARK standard was set up by the Directorate of Marketing and Inspection of the Government of India by introducing an Agricultural produce Act in 1937. The word 'AGMARK' seal ensures quality and purity.

Conclusion

The six main components of food those our body needs are – carbohydrate, protein, fat, minerals, vitamins and water. The food is the base of our life. Through food we get these six components easily. Our body needs pure, fresh and healthy food for proper functioning of physiological process. But day by day, availability of pure, fresh and healthy food from market is becoming history. Therefore, several health complicacies are observing now-a-days in community health life as well as national health life. In recent life, health problem is the identity of life of individual. Health is wealth, health is prosperity, health is happiness and health is dynamism. Therefore, without proper health, an individual, a community, a nation, a civilization how much day will survive? Food adulteration has become rampant in India as well as many other countries of the world also. Hence, if we unable to check/prevent the food adulteration, it may be the silent beginning of destruction of present civilization. Therefore, several measures are to be taken at individual level, community level and government level to prevent the food adulteration.

These are the following

- **Provision of education: -** Education is the production of desirable changes in human behavior. Through proper education, individual shows his proper behavior. Education gives realization from heart. Hence, a fool can do any work easily but an educated person does not do all work easily or blindly but do the work with brain.
- **Population control: -** More population, more food is needed; hence, it is widening the gate of food adulteration.
- **Alleviation of poverty: -** Nearly one third population of our country are still in below poverty line (BPL). Therefore, alleviation of poverty is needed on urgent basis. Otherwise, poverty –stricken people do not know which one is good which one is bad work for society or civilization, because pain of empty stomach is unbearable.
- **Provision of employment: -** Due to lack of employment, a certain part of uneducated or semi-educated people employing themselves in food selling as self-employed. Their quick earning aspiration, quick to become a rich man, doing lot of activities to make food adulterated.
- **Food selling is not everyone's business: -** Doing business, license is needed. But in case of food selling no license is needed, so anybody can anytime open a shop and sell food. As a result, food adulteration in market is happening just like a tide. Therefore, need to control it. There is need to introduce stringent rule to get license on food business and prepared food business. The food is the most sensitive part of our life. Good food means good life. Though the govt. has no strict measures to provide license to food sellers though in other matters (other businesses) having proper rule and regulation. Therefore, it is need of the hour to concentrate our mind on food items and their proper selling.
- **Regular inspection of food market:-** Regular inspection of food market is needed by food inspector. So, the sellers' mind will get a fear to adulterate the food, otherwise our food markets will be heaven of food

adulteration. In an accident, one person or few persons is/are died/killed, but by food adulteration an individual, a community, a nation will die, whole civilization will be destroyed. Govt. should implement food inspection strictly with prime importance.

- **Organic farming:** Farmers of our country are to be encouraged to cultivate crop organically, so foods will be out of residual effect of pesticides.
- **Proper storage of food:** Agricultural products are perishable in nature, therefore proper storage of these products are needed, otherwise due to deterioration of food quality-it will be adulterated food. Whatever agricultural products produced in our country-its' 33-40 percent food become waste, due to lack of proper storage facility especially lack of cold storage facility.
- Knowledge on prevention of food adulteration should be provided at school level education.
- **National food adulteration control mission: -** Central govt. is spending crores of Rs. for National Health Mission. Time has come to spend quite money for food adulteration control, because food adulteration is the source of many health problems of citizens.
- **Hard punishment for foreign companies who are adulterating food:**- Foreign companies who are doing business in India, if any kind of adulteration is seen in their product, the accused company's business license will be seized and ousted from country. Otherwise impose heavy monetary punishment. Its' purpose is to give them a lesson that you cannot play with health of our citizens, progress and prosperity of our country.
- **Festival time supervision:** Fair or festival time maximum adulteration happens. Therefore, that time food quality control department and even mela/fair/festival committee will play an active role to check the food adulteration.
- **Proper food laws should be introduced:**- In existing law intensity of punishment is quite low, therefore, trader having a do not care attitude. Hence, stringent punishment should be implemented so the traders become afraid to do food adulteration.
- **More initiative measures on food adulteration control are needed from government side: -** Govt. efforts will be more active (like a rabit) instead of present day's activeness (like a tortoise).
- **Social responsibility: -** To save the society, to save the nation- it is everybody's responsibility. Therefore, everybody will be more careful in their own occupation. According to poet's words-everybody for everybody's need, everybody for others' need. We alone cannot live in society because we are social animal. Food adulteration is really a burning issue. If we (the administrators, politicians, policy makers, economists, extensionists etc.) understand it, then it is very fine that we will take several measures to prevent it. Otherwise, this burning issue itself silently will burn the civilization day by day.
- **Politicians should raise their voice:-** Aboveall, Politicians will be more vocal on food adulteration control. They will raise this issue at Loksabha or Rajyasabha for enactment of new effective food adulteration control law. Even if each MLA or MP be careful of their own constituencies, food adulteration will check upto a certain extent.

"To keep the body in good health is a duty, otherwise we shall not be able to keep our mind strong and clear." ― Buddha

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