



## ADULTERATION OF FOOD, ITS IMPLICATIONS & DETECTION - AN AYURVEDIC COMPREHENSION

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**ABSTRACT** Food is one of the basic necessities of life and provides nutrients that are essential for the growth, repair, and maintenance and repair of body tissues and for the regulation of vital processes. There are different types of food available today in the market, and on a daily basis, we all depend on various food sources, including vegetables, fruits, cereals, pulses, legumes, etc. Adulteration or contamination of natural food products is one of the major challenges in today's society. Despite various actions and penalties, the process of contaminating food or adding to the food components is a common phenomenon in developing countries. It has reached the highest point that it is very difficult to find a sector of food industry which is free from adulteration. Every day newer methods of adulteration and newer types of foods are seen in news. Adulteration in food is often present in its most crude form as prohibited substances are either added partially or wholly. There are various methods used for adulterating natural products. Having this adulterated food is highly toxic and leads to several health issues. Adulteration is referred as Apamishrana in Ayurveda. The ancient Ayurvedic Classics have dealt in detail regarding different modes of apamishrana and also the characters of artificially prepared ones in respective contexts. This article elucidates testing methods for common adulterants which can be easily performed by the consumer in the households.

**KEYWORDS :** Food, Adulteration, Apamishrana, Gara - Visha

### INTRODUCTION:

Food Adulteration refers to the process by which the quality or the nature of a given food is reduced through addition of adulterants or removal of vital substance. Food adulterants refer to the foreign and usually inferior chemical substance present in food that cause harm or is unwanted in the food. Basically, during food adulteration, small quantity of non-nutritious substances is added intentionally to improve the appearance, texture or storage properties of the food.

It is a debasement of article intentionally for commercial purpose or accidentally due to lack of knowledge of identification and proper collection. Substitution is a replacement of equivalent drugs in place of original drugs on the basis of similar Rasa, Guna, Veerya, Vipak and mostly on Karma.

Food adulteration has been a major issue since ancient times as it decreases the quality of food and it can be injurious to health. Typical substances that are adulterated are not limited to food, cosmetics, pharmaceuticals, fuel, or other chemicals, that compromise the safety or effectiveness of the said substance.

According to The Prevention of Food Article Act, 1954, an article of food shall be deemed to be adulterated—

(a) if the article sold by a vendor is not of the nature, substance or quality demanded by the purchaser and is to his prejudice, or is not of the nature, substance or quality which it purports or is represented to be;

(b) if the article contains any other substance which affects, or if the article is so processed as to affect, injuriously the nature, substance or quality thereof;

(c) if any inferior or cheaper substance has been substituted wholly or in part for the article so as to affect injuriously the nature, substance or quality thereof;

(d) if any constituent of the article has been wholly or in part abstracted so as to affect injuriously the nature, substance or quality thereof;

(e) if the article had been prepared, packed or kept under insanitary conditions whereby it has become contaminated or injurious to health;

(f) if the article consists wholly or in part of any filthy, putrid, rotten, decomposed or diseased animal or vegetable substance or is insect-infested or is otherwise unfit for human consumption;

(g) if the article is obtained from a diseased animal;

(h) if the article contains any poisonous or other ingredient which renders it injurious to health;

(i) if the container of the article is composed, whether wholly or in part, of any poisonous or deleterious substance which renders its contents injurious to health;

(j) if any colouring matter other than that prescribed in respect thereof is present in the article, or if the amounts of the prescribed colouring matter which is present in the article are not within the prescribed limits of variability

(k) if the article contains any prohibited preservative or permitted preservative in excess of the prescribed limits;

(l) if the quality or purity of the article falls below the prescribed standard or its constituents are present in quantities not within the prescribed limits of variability, but which renders it injurious to health;

(m) if the quality or purity of the article falls below the prescribed standard or its constituents are present in quantities not within the prescribed limits of variability

The Adulterated food has been linked to various chronic diseases like liver disorder, diarrhoea, stomach disorder, lathyrism, cancer, vomiting, dysentery, joint pain, heart diseases, food poisoning etc.

### DEFINITION:

1. According to Food Safety and Standards Authority of India (FSSAI) Act, 2006 "Food adulteration is an act of intentionally debasing the quality of food offered for sale either by the admixture or substitution of inferior substances or by the removal of some valuable ingredient"<sup>(1)</sup>. It can be through:

- I) Deliberate addition
- II) Substitution
- III) Removal of substances

2. To corrupt, debase, or make impure by the addition of a foreign or inferior substance or element to prepare for sale by omitting a valuable ingredient or by replacing more valuable ingredients with less valuable or inert and usually harmful ingredients or with ingredients different from those claimed.

Even in Ayurveda there are references of the food having harmful effects on body, be it due to addition of poisonous substances or due to improper combination. One among such concepts is the concept of garavisha. It is a type of artificial poisoning where there is poisonous

effects due to addition of substances, mostly intentionally.

It can be seen that the effects on consumption of adulterated food are very similar to those of garavisha. The harmful effects of these poisons may be of wide variety based on the properties of the combined substances. The prevention and treatment of those abnormal health events due to adulteration can thus be adopted as per the garavisha line of treatment.

Ayurveda also talks about deliberate poisoning for specific gains with the use of the phrase soubhagyaartha in the definition of garavisha<sup>(2)</sup>. Even the word garaartha by Chakrapani shows the deliberate nature of the poisoning which can also be seen as corresponding to intentional adulteration.

**TYPES OF GARAVISHA:**

S.No.	TYPE	EXPLANATION
1.	Nana prani angaamsa Mala	Biological contamination of food in the form of microbes, fungus, insect body parts, waste products of rodents etc
2.	Viruddha Oushadhi Bhasma	Addition of unsafe organic matter like poisonous plant parts and the metallic contamination
3.	Alpaveerya Visha	Poisonous substances in the form of chemical additives, preservatives, pesticides etc.

**TYPES (MODERN):**

S.No.	TYPE	SUB - TYPE	EXPLANATION
1.	Intentional	Deterioration	Intentional impairment in the quality of drug is Deterioration
		Sophistication	Sophistication is the intentional or deliberate type of adulteration in which some totally different substance is added in place of genuine drug
		Substitution/ Inferiority	Adding of any substandard drug
2.	Incidental	Admixture	Addition or mixing one substance to another accidentally or carelessly or due to ignorance is Admixture. It is a type of unintentional adulteration
		Spoilage	Spoilage is due to the attack of microorganisms or parasitic infestation.

**REASONS:**

The main reasons for adulterating food products are listed below

- Practiced as a part of the business strategy.
- An imitation of some other food substance.
- Lack of knowledge of proper food consumption.
- To increase the quantity of food production and sales.
- Increased food demand for a rapidly growing population.
- To make maximum profit from food items by fewer investments.

**METHODS:**

S.No.	METHOD	EXPLANATION
1.	Mixing	Mixing of clay, stones, pebbles, sand, marble chips, etc.
2.	Substitution	Cheaper and inferior substances being replaced wholly or partially with good ones.
3.	Concealing Quality	To hide the food standard. eg. adding captions of qualitative food to low quality for selling.
4.	Decomposed food	Mainly in fruits and vegetables. The decomposed ones are mixed with good ones
5.	Misbranding/ False labels	Includes duplicate food stuffs, changing of manufacture and expiry dates.

6.	Addition of toxicants	Adding non-edible substances like argemone in mustard oil, low quality preservatives, colouring agents, etc.
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**ADULTERANTS AND THEIR EFFECTS**

S. No	Foods	Adulterants	Diseases
1.	Edible oils and fats, Black pepper	Mineral oil (White oil, Petroleum fractions)	Cancer
2.	Turmeric whole & powdered, mixed spices	Lead chromate	Anemia, Abortion, Paralysis & Brain damage
3.	Methanol	Alcoholic liquors	Blurred vision, Blindness & Death
4.	Fruits such as apples sprayed over with lead arsenate	Arsenic	Dizziness, Chills, Cramps, Paralysis & Death
5.	Foods contaminated by Rat poisons (Barium carbonate)	Barium	Violent peristalsis, Arterial hypertension, Muscular twitching, Convulsions & Cardiac disturbances
6.	Fruit juices, Soft drinks, etc. in contact with Cadmium plated vessels / equipment	Cadmium	Itai-itai (ouch-ouch) disease, Increased salivation, Acute gastritis, Liver & Kidney damage & Prostate cancer
7.	Water, liquors	Cobalt	Cardiac insufficiency & Myocardial failure
8.	Water, natural and processed food	Lead	Lead poisoning (Foot-drop, Insomnia, Anemia & Constipation)
9.	Mustard seeds, Edible oils & Fats	Argemone seeds & oil	Epidemic dropsy, Glaucoma & Cardiac arrest
10.	As a substitute for Cumin seed, Poppy seed & Black pepper	Artificially coloured foreign seeds	Injurious to health
11.	Tea	Foreign leaves or exhausted Tea leaves, Saw dust & Artificially coloured	Injurious to health & Cancer
12.	Oils	TCP (Tricresyl phosphate)	Paralysis
		Rancid oil	Destroys vitamin A and E
13.	Food grains, pulses etc.	Sand, marble chips, stones, filth	Damage digestive tract
14.	Khesari dal alone or Mixed in other pulses	Lathyrus sativus	Lathyrism (crippling spastic paraplegia)

The common people can protect themselves from the hazards of adulteration by being conscious of what they buy and eat. Testing foods that are commonly adulterated for their purity before consumption is a very effective way of preventing health hazards. The FSSAI has brought out some simple tests to be performed on common food items to test for their purity. The following are some of the easy tests that can be tried.

**QUICK DETECTION TESTS**

S. No	Food Article	Adulterant	Harmful Effects	Detection
1.	Milk	Unhygienic water  Starch  Synthetic milk	Stomach disorder	(I) Put a drop of milk on a polished slanting surface – Flows slowly leaving a white mark behind it – Pure milk Flows immediately without leaving a mark - adulterated milk  (ii) Add few drops of 1% Iodine solution to the milk - Formation of blue color indicate the presence of starch. (iii) Synthetic milk has a bitter after taste, soapy feeling on rubbing between fingers & turns yellow on heating.
2.	Coffee Powder	Clay, Tamarind seed & Chicory powder	Diarrhoea Stomach disorder, Giddiness & Joint pain	(I) Add ½ teaspoon of coffee powder in a transparent glass of water: Stir for a minute and keep it aside for 5 minutes. Observe the glass at the bottom. Pure coffee powder will not leave any clay particles at the bottom. If coffee powder is adulterated, clay particles will settle at the bottom. (ii) Gently sprinkle coffee powder on the surface of water in a glass. The coffee will float whereas chicory will start to sink within a few seconds. Falling chicory powder will leave a trail of colour behind due to the large amounts of caramel it contains. (iii) Pinch test: Take a little coffee and squeeze it between your fingers. If it forms a cake-like coherent mass, it is adulterated with chicory.
3.	Sugar	Chalk powder  Urea	Highly toxic to human body & It can cause Stomach disorders	(I) Dissolve 10 gm of sample in a glass of water. Sugar will dissolve chalk powder will settle down at the bottom. (ii) On dissolving in water it gives a smell of ammonia.
4.	Honey	Water / sugar solution.	Affects the quality of the product & It can cause Stomach disorders	A cotton wick dipped in pure honey when lit with match stick / lighter will burn showing its purity, but if it is adulterated the water content won't allow it to burn. Pure honey will not disperse; however, if it disperses in water, it indicates the presence of added sugar.

5.	Jaggery	Washing soda  Chalk powder	Vomiting & Diarrhoea	(I) Add a few drops of HCL solution. Froth shows presence of washing soda. (ii) Dissolve a little amount of sample in water in a test tube, chalk powder settles down.
6.	Common Salt	Chalk powder	Highly toxic to human body	Mix a sample with a glass of water. Salt will dissolve chalk powder will settle down.
7.	Iodized Salt	Common salt	Affects the quality of the product.	Cut a piece of potato, add salt & wait a minute & add two drops of lemon juice. If iodized salt blue colour will appear & in case of common salt, there will be no blue colour
8.	Green Peas	Artificially colored (Coal tar dye)	Stomach pain & Ulcer	Take 250ml of water in a beaker soak peas into it. Clear separation of colour in water shows adulteration.
9.	Green Chilli & Green Vegetables	Malachite green	Artificial colors can be dangerous.	Take a cotton piece, soak in paraffin & rub over outer surface of the vegetable. If the cotton turns green we say that vegetable is adulterated by malachite green.
10.	Sweet Potato	Rhodamine B colour	Artificial colors can be dangerous.	Take a cotton piece, soak in paraffin & rub over outer surface of the vegetable. If the cotton absorbs the colour we say that vegetable is adulterated by Rhodamine B colour.
11.	Turmeric Powder / Besan / Dals	Metanil yellow, Kesari dal	It is highly Carcinogenic and can lead to Stomach disorders if consumed continuously.	Dissolve spoonful of Turmeric powder or Besan in 20 ml of lukewarm water. Add any acid easily available at home like lemon (acetic acid), oranges (citrus acid) or any ascorbic acid (vitamin C fruits). If the water turns pink, violet or purple, it is adulterated.
12.	Chilli powder	Brick powder, saw dust  Artificial Colours	Stomach problems  Cancer	Take a TSF of chillies powder in a glass of water. Coloured water extract will show the presence of artificial colour. Artificial colourants descend as coloured streaks.
13.	Mustard powder	Argemone seeds	Epidemic Dropsy & Glaucoma	If Mustard seed is pressed inside it is yellow while for Argemone seed it is white
14.	Hingu	Foreign resins	Dysentery	Burn on a spoon, if the sample burns like camphor, it indicates the sample is pure.

15.	Cloves	Volatile oil has been extracted  Coated with mineral oil	Cheating waste of money (exhausted cloves)	(I) Small size & shrunken appearance. Characteristic pungent of genuine cloves is less pronounced in exhausted cloves. (ii) Gives Kerosene like smell
16.	Black Pepper	Papaya seeds	It can cause severe liver problems	Put a sample in alcohol. Pepper seeds will sink & papaya seeds will float as they are lighter.
17.	Bengal gram & Toor dal	Kesari dal	Lathyrism & Cancer	(I) Kesari dal has edged type appearance showing a slant on one side & square in appearance in contrast to other dals. (ii) Add 50 ml of dilute HCL to the sample & keep on simmering water for about 15 min. the pink colour developed indicates the presence of Kesari dal.
18.	Wheat & Other food grains (Bajra)	Ergot (a fungus containing poisonous substance)	Poisonous	(I) Purple black longer sized grains in Bajra show the presence of Ergots (ii) Put some grains in a glass tumbler containing 20% salt solution – Purple black longer size grain Ergot floats over the surface while round grains settle down.
19.	Vanaspatti	Cheap edible oil	Cardiac problems, diabetes, PCOS, thyroid, fatty liver & obesity	(I) Add a solution of washing soda to vanaspatti and shake well - If froth appears on top, cheap oil has been added to vanaspatti
20.	Edible oils	Argemone oil	Loss of Eye-sight, Heart diseases & Tumour	It is an adulterant to mustard oil. Ferric chloride reacts with argemone oil in hydrochloric acid medium to produce small needle shaped reddish brown crystals.
		Mineral oil	Liver damage & Carcinogenic effects	To 1 ml oil or fat, add 25 ml alcoholic caustic potash. Boil in water bath, till it becomes quite clear. The presence of turbidity indicates presence of mineral oil.
		Karanja oil	Heart problems & Liver damage	Take 5 ml of sample oil in a test tube; add 10 ml ethyl alcohol to it followed by addition of 5 drops of ferric chloride solution. Shake vigorously 2 min. & allow to stand for 2 hrs. The development of light blue to dark colour in the alcoholic layer indicates the presence of Karanja oil.

		Castor oil	Stomach problem	Take 1 ml of the sample to be tested in a clean test-tube & add acidified petroleum ether (60- 80°). Shake it thoroughly; add a drop ammonium molybdate solution. Development of white turbidity indicates the presence of castor oil.
21.	Ice Cream	Washing powder	It can cause severe stomach & liver disorders	Squeeze a few drops of lemon juice on the ice cream. If it starts to froth and bubble, it has washing powder in it.
22.	Sweets, Juices, Jam	Metanil Yellow (Non-permitted Coal tar dye)	Metanil yellow is toxic & Carcinogenic	Extract colour with luke-warm water from food articles. Add few drops of conc. HCL. If magenta red colour develops the presence of metanil yellow is indicated.
23.	Khoa	Starch & Less Fat content	Less - nutritive value	Boil a small quantity of sample with some water, cool & add few drops of iodine solution. Formation of blue colour indicates the presence starch
24.	Supari	Colour  Saccharin	Cancer	(I) Colour dissolves in water (ii) Saccharin gives excessive & lingering sweet taste & leaves bitter taste at the end.

**MITIGATION MEASURES FOR ADDRESSING FOOD ADULTERATION:**

- There must be proper surveillance of the implementation food laws.
- There should be monitoring of the activities with periodical records of hazards regarding food adulteration.
- There should be periodical training programmes for Senior Officer/Inspector/Analysts for food safety
- There should be consumer awareness programmes organized by holding exhibitions/seminars/training programmes and publishing pamphlets.
- There should be strict actions regarding the punishment for those who are involved in food adulteration.
- There should be help and support from International INGOs for implementation of food laws.

One of the most effective ways could be by raising the standard of public morals and spreading awareness among manufacturers, traders and consumers. This would essentially root out the menace of adulteration. It is also necessary that those who infringe the food laws must be hunted out, prosecuted and suitably punished. This will serve as a deterrent to others who may be tempted to make a fast buck at the cost of human life.

**MANAGEMENT:**

The management of the harmful effects of food adulteration is dependent on the type of adulterant and period of exposure. Even so, the steps of management can be broadly divided under the main headings like:

S.No.	Treatment Modality	Ayurvedic Parlance
1.	Removal of toxins	Sadyah Vamana
2.	Prevention of further exposure	Pathya Bhojana
3.	Management of symptoms	Shamana Chikitsa & Agada Prayoga
4.	Rehabilitative food & Life style Modification	Hitahaara & Vihara Sevana

**DISCUSSION:**

In Ayurveda it is told that food is reason for both the nourishment of living body and its Diseases. It is considered one among the trayopasthambha (Pillars of life). Importance of food is reflected in the tremendous impact it has on the health of a person even with a slight change in its quality. Thus it is important to watch what we eat.

The addition or deletion of substances in food items have made it hazardous to the same body that it nourishes. This intentional or unintentional change in the quality is called adulteration. Thus for the safety of the food each country now has their own standards and also governing bodies to ensure that all the products comply with the set standards.

**CONCLUSION:**

Advent of Science and food marketing and globalization has increased the cases of food adulteration. Several laws have been enacted and implemented by the Central and State Governments to help maintain food quality at various stages from production through storage, processing, internal and external trade and consumption. The Prevention of Food Adulteration (PFA) Act, 1954 and the Prevention of Food Adulteration Rules, 1955 are the main statutes which protect the consumer and aim to provide him safe food:

However, it cannot be denied that many cases of adulteration occur simply due to the negligence and lack of awareness on the part of manufacturers, distributors or retailers. In Ayurveda, since the explanation was given in different angles for the concepts. Hence, The ancient knowledge in Ayurveda can be used to counter act the negative health effects due to the inferior quality of food now a days by judicious use of purificatory therapies and antidotes.

**REFERENCES:**

1. Quick test for some adulterants in food –Food safety and standards authority of India (FSSAI), New Delhi, 2012
2. Sharma, R.K & Bhagawan Das, Charaka Samhita, Chikitsa Sthana (23/233), Vol. IV, Varanasi, Chaukhambha Sanskrit Series office, Reprint, 2014, 380
3. <https://www.slideshare.net/himajadonthula/presentation-on-adulteration-in-fats-and-oils-manoj>
4. <https://www.slideshare.net/enigmisha/food-adulteration-52244831>
5. <https://www.slideshare.net/RizwaanMohammed/food-adulteration-52408347>
6. <https://www.slideshare.net/rifatnaz61amc/food-adulteration-54846488>
7. <https://www.slideshare.net/ElakkiyaThangaraju/adulteration-65185398>
8. <https://www.slideshare.net/moocsengine/adulteration-in-foods>
9. <https://www.slideshare.net/esfaquel/food-adulteration>
10. <https://myessaypoint.com/harmful-effects-food-adulteration>
11. <https://technologytimes.pk/post.php?title=Hazards+of+food+adulteration+in+human+health>
12. <https://www.balancenutrition.in/blog/health-reads/health-diet/how-does-food-adulteration-impact-our-health>
13. <http://www.indiastudychannel.com/resources/172754-Adulteration-and-Harmful-effects-of-Food-Adulteration.aspx>
14. <http://tripti.expertscolumn.com/article/some-facts-about-food-adulteration>
15. <http://foodravel.com/2016/07/29/food-adulteration/>
16. <http://earthuntouched.com/food-adulteration-impact/>
17. <https://www.quora.com/What-is-the-reason-for-increasing-adulteration-and-increasing-price-of-milk-in-India>
18. <http://essayarticle.com/food-adulteration/>
19. <https://www.slideshare.net/msdhillon72/the-prevention-of-food-adulteration-act>
20. [https://archive.india.gov.in/sectors/health\\_family/food\\_prevention.php](https://archive.india.gov.in/sectors/health_family/food_prevention.php)
21. <https://www.slideshare.net/PrajeeshNath/pfa-62880422>
22. <https://www.slideshare.net/dipteshpatil32/the-prevention-of-food-adulteration-act-1954>
23. <http://extwprlegs1.fao.org/docs/pdf/ind10950.pdf>