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ADULTERANTS AND SUBSTITUTES OF FOODS AND HERBS: A REVIEW

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ABSTRACT

Adulteration in food is normally present in its most crude form, prohibited substances are either added or partly or wholly substituted. In India normally the contamination/adulteration in food is done either for financial gain or due to carelessness and lack in proper hygienic condition of processing, storing, transportation and marketing. This ultimately results that the consumer is either cheated or often become victim of diseases. Such type of adulteration is quite common in developing countries or backward countries. However, adequate precautions taken by the consumer at the time of purchase of such products can make him alert to avoid procurements of such food. It is equally important for the consumer to know the common adulterants and their effect on health. So the present paper deals with the list of adulterants that are added to food items and herbs.

Keywords: Adulteration, *Piper nigrum*, *Carthamus tinctorius*, *Carthamus tinctorius*, Papaya.

INTRODUCTION

Traditional herbal medicine and their preparations have been widely used for the thousands of years in developing and developed countries owing to its natural origin and lesser side effects or dissatisfaction with the results of synthetic drugs. However, one of the characteristics of oriental herbal medicine preparations is that all the herbal medicines, either presenting as single herbs or as collections of herbs in composite formulae, is extracted with boiling water during the decoction process. This may be the main reason why quality control of oriental herbal drugs is more difficult than that of western drug. As pointed in "General Guidelines for Methodologies on Research and Evaluation of Traditional Medicines," "Despite its existence and continued use over many centuries, and its popularity and extensive use during the last decade, traditional medicine has not been officially recognized in most countries [1].

In olden days Vedas used to treat patients on individual basis and prepare drug according to the requirement of the patient but now the scene has changed, herbal medicines are being manufactured on large scale where manufacturers come across many problems such as

availability of good quality raw material, authentication of raw material, availability of standards, proper standardization methodology of single drugs and formulation, quality control parameters etc; hence the concept of quality from very first step is paramount factor must get good attention.

The chemistry of plants involves the presence of therapeutically important constituents usually associated with many inert substances (coloring agents, cellulose, lignin etc). The active principles are extracted from the plants and purified for therapeutic utility for their selective pharmacological activity. So quality control of herbal crude drugs and their constituents is of great importance in modern system of medicine. Lack of proper standard parameters for the standardization of herbal preparation and several instances of substandard herbs, adulterated herbs come into existence. To meet new thrust of inquisitiveness, standardization of herbals is mandatory. Hence every single herb needs to be quality checked to ascertain that it confirms to quality requirement and delivers the properties consistently. Standardization assures that products are reliable in terms of quality, efficacy, performance and safety. It is however observed

that the drugs in commerce are frequently adulterated and do not comply with the standards prescribed for authentic drug.

Drug adulteration

The adulteration and substitution of herbal drugs is the burning problem in herbal industry and it has caused a major effect in the commercial use of natural products. Adulteration in market samples is one of the greatest drawbacks in promotion of herbal products. Adulteration it is a practice of substituting the original crude drug partially or fully with other substances which is either free from or inferior in therapeutic and chemical properties or addition of low grade or spoiled drugs or entirely different drug similar to that of original drug substituted with an intention of enhancement of profits. Or adulteration may be defined as mixing or substituting the original drug material with other spurious, inferior, defective, spoiled, useless other parts of same or different plant or harmful substances or drug which do not confirm with the official standards.

Adulteration may takes place by two ways:

- Direct or intentional adulteration
- Indirect or unintentional adulteration

Direct or intentional adulteration

Direct or intentional adulteration is done intentionally which usually includes practices in which an herbal drug is substituted partially or fully with other inferior products. Due to morphological resemblance to the authentic herb, many different inferior commercial varieties are used as adulterants. These may or may not have any chemical or therapeutic potential. Substitution by "exhausted" drugs entails adulteration of the plant material with the same plant material devoid of the active constituents. This practice is most common in the case of volatile oil-containing materials, where the dried exhausted material resembles the original drug but is free of the essential oils. Foreign matter such as other parts of the same plant with no active ingredients, sand and stones, manufactured artifacts, and synthetic inferior principles are used as substitutes. The practice of intentional adulteration is mainly encouraged by traders who are reluctant to pay premium prices for herbs of superior quality, and hence are inclined to purchase only the cheaper products. This encourages producers and traders to sell herbs of inferior quality.

With artificially manufactured materials

Substances artificially manufactured being resembles with original drug are used as substitutes. This practice is generally followed for much costlier drug e.g. nutmeg is adulterated with basswood prepared to the required shape and size; the colored paraffin wax is used in place of beeswax.

With inferior quality materials

Inferior quality material may or may not have same chemical or therapeutic value as that of original natural drug due to their morphological resemblance to authentic drug, they are marketed as adulterants e.g. *Belladonna* leaves are substituted with *Ailanthus* leaves, *papaya* seeds to adulterate *Piper nigrum*, mother cloves and clove stalks are mixed with clove, beeswax is substituted by Japan wax [2].

With exhausted material

Many drugs extracted on large scale for isolation of active principle, volatile oils etc. the exhausted material may be used entirely or in part as a substituent for the genuine drug e.g. umbelliferous fruits and cloves (without volatile oils) are adulterated with exhausted (without volatile oils) original drugs, exhausted jalap and Indian hemp (without resins) are used as adulterant.

With foreign matter

Sometimes synthetic chemicals are used to enhance the natural character e.g. addition of benzyl benzoate to balsam of Peru, citral to citrus oils like oil of lemon and orange oil etc [3].

With harmful / fictitious substances

Sometimes the wastes from market are collected and admixed with authentic drugs particularly for liquids or unorganized drugs e.g. pieces of amber colored glass in colophony, limestone in asafetida, lead shot in opium, white oil in coconut oil, cocoa butter with stearin or paraffin [4].

Adulteration of powders

Besides entire drug powder form frequently found to be adulterated e.g. powder liquorice or gentian admixed with powder olive stones, under the name of cinchona, *C. calisaya* wedd., *C. officinalis* Linn.f., *C. ledgeriana* and *C. succirubra* are available as mixtures.

Indirect or unintentional adulteration

Unintentional or undeliberately adulteration which sometimes occurs without bad intention of the manufacturer or supplier. Sometimes in the absence of proper means of evaluation, an authentic drug partially or fully devoid of the active ingredients may enter the market. Factors such as geographical sources, growing conditions, processing, and storage are all factors that influence the quality of the drug [5].

Faulty collection

Some of the herbal adulteration is due to the carelessness of herbal collectors and suppliers. The correct part of genuine plant should be collected. Other less valuable part of the genuine plant should not be collected. Moreover collection should be carried out at a proper

season and time when the active constituents reach maximum. *Datura strumarium* leaves should be collected during flowering stage and wild cherry bark in autumn etc. collection from other plant by ignorance, due to similarity in the appearance, color, lack of knowledge may lead to adulteration. For example in place of *Aconitum napellus*, the other *Aconitum deinorhizum* may be collected or in place of *Rhamnus purshiana* (cascara bark) *Rhamnus colifornica* is generally collected. Confusion existing in the common vernacular name of different plant in various states of India may lead to this type of adulteration. Often in different states the same plant is known by different vernacular names, while quite different drugs are known by same name. This creates confusion which is best illustrated by Punarnava and Brahmi. The Indian pharmacopoeia drugs *Trianthema portulacastrum* L. and *Boerhavia diffusa* L. are both known by the same vernacular name "Punarnava" [6].

Imperfect preparation

Non removal of associated structures eg stems are collected with leaves, flowers, fruits. Non-removal of undesirable parts or structures e.g. cork should be removed from ginger rhizome. Proper drying conditions should be adhered. Improper drying may lead to unintentional adulteration e.g. if digitalis leaves are dried above 65°C decomposition of glycosides by enzymatic hydrolysis. Use of excessive heat in separating the cod liver oil from livers, where the proportions of vitamins, odor and color etc are adversely affected [7].

Incorrect storage

Deterioration especially during storage, leading to the loss of the active ingredients, production of metabolites with no activity and, in extreme cases, the production of toxic metabolites. Physical factors such as

air (oxygen), humidity, light, and temperature can bring about deterioration directly or indirectly. These factors, alone or in combination, can lead to the development of organisms such as molds, mites, and bacteria. Oxidation of the constituents of a drug can be brought about by oxygen in the air, causing some products, such as essential oils, to resinify or to become rancid. Moisture or humidity and elevated temperatures can accelerate enzymatic activities, leading to changes in the physical appearance and decomposition of the herb. For example volatile oils should be protected from light and stored in well closed containers in cool place. Belladonna leaf should be stored in moisture free containers, which may cause enzymatic action lead to decomposition of medicinally active constituents. Mites, nematode worms, insects/moths, and beetles can also destroy herbal drugs during storage.

Gross substitution with plant material

Due to morphological resemblance i.e. similarity in appearance, colors etc the genuine crude drugs are substituted with others are very often sold in the market e.g. *Podophyllum peltatum* L. is used as a substitute for *P. hexandrum*, *Belladonna* leaves are substituted with *Ailanthus* leaves, saffron is admixed with dried flowers of *Carthamus tinctorius*, mother cloves and clove stalks are mixed with clove [7].

Substitution with exhausted drugs

In this type, the same drug is admixed but devoid of any medicinally active constituents as they are already extracted out. This practice is more common in case of volatile oil containing drugs like fennel, clove, coriander, caraway etc. sometime, natural characters of exhausted drugs like color and taste are manipulated by adding other additives and then it is substituted eg exhausted gentian made bitter with aloes [8].

Table 1. List of common adulterants and substitutes of food and herbs

S.No.	Name	Adulterant
1	Black pepper	Dried papaya seeds, Millet or Buckwheat flour, Light berries
2	Arahar dal	Yellow dye, Kesari dal
3	Coffee powder	Chicory, Tamarind seeds
4	Gram dal	Kesari dal, Clay, Stone
5	Butter and Pure desi ghee	Starch, Vanaspati ghee, Smashed potato
6	Milk	Water, starch, Fatless milk
7	Jeera	Stone, Alike seeds from wild Plants
8	Chilly powder	Brick powder, Artificial colours
9	Sugar	Fine white sand, Chalk powder, Rawa
10	Cereals	Stone pieces, Mud, Ergot seeds
11	Mustard seeds	Argemone seeds
12	green peas	Malachite Green
13	Ice cream	Pepperonil, Ethylacetate, Butraldehyde, Emil Acetate, Nitrate, Washing Powder
14	Red wine	Juice of Bilberries or Elderberries
15	Turmeric powder	Coloured chalk powder, Lead chromate, Metanil yellow
16	Edible oils and fat	Argemone oil

17	Tea	Foreign leaves or exhausted tea leaves, Saw dust artificially coloured
18	Ground spice	Spent spices, Starch, Grains, Hulls, Added oleoresins
19	Oregano	Foreign leaves, i.e. Sumac, Cistus, Savory, Thyme, Marjoram
20	Saffron	Floral waste, Added artificial color, Dried tendrils of maize cob
21	White pepper	Millet seed
22	Vegetable ghee	Hydrocarbon and Paraffin wax
23	Wheat, Rice, Maize, Jawar, Bajra, Chana, Barley, etc.	Dust, Pebble, Stone, Straw, Weed Seeds, Damaged Grain, Weevil Led Grain, Insects, Rodent Hair And Excreta. Ergot (A fungus containing poisonous substance), Dhatura, Karnel Bunt, Argemone seed
24	Atta, Maida, Suji (Rawa)	Sand, Soil, Insects, Webs, Lumps, Rodent Hair and Excreta, Iron Fillings
25	Besan	Khesari flour
26	Cloves	Volatile oil extrated (exhausted cloves)
27	Hing	Soap stone or other Earthy matter
28	Common Salt	White Powdered Stone
29	Pan masala	Colour and Saccharin
30	Catechu powder	Chalk
31	Silver leaves	Aluminium leaves
32	Vinegar	Mineral acid
33	Oils	Rancid oil
34	Mixed spices	Lead chromate, powdered bran and saw dust
35	Alcoholic liquors	Methanol
36	Fruit juices, soft drink	Cadmium
37	water	Cobalt
38	Silver foil	Aluminium foil
39	Honey	Water
40	Bajra	Ergot infested bajra
41	Coriander powder	Dung powder, common salt
42	Cumin seeds	Grass seeds coloured with charcoal dust
43	Asafoetida	Soap stone or earthy matter, chalk
44	Cardamom	Loose seeds or fully riped seeds of cardamom
45	Coriander	Bombay coriander fruits
46	Isapgol seeds	<i>Plantago lanceolata</i> seeds
47	Indian gum	Gum ghatii
48	Starch	Tapioca starch, Cassava, Brazilian arrowroot
49	Indian senna	Dog senna, Palthe senna
50	Alexandrian senna	Dog senna, Palthe senna, Bombay, Mecca or Arabian Senna
51	Cascara	Barks of <i>R californica</i> , <i>R fallax</i> and Frangula bark
52	Aloes	Natal aloes, Mocha Aloes, Black Catechu, Pieces of Iron and Stones
53	Digitalis	Primrose leaves, Comfrey leaves
54	Liquorice	Russian Liquorice
55	Chirata	<i>S densifolia</i>
56	Nux vomica seeds	Dried seeds of <i>Strychnos nuxblanda</i>
57	opium	Manipulated Turkish opium
58	belladona	Leaves of <i>Phytolacca Americana</i> , <i>Solanum nigrum</i>
59	Stramonium leaves	<i>Solanum nigrum</i> leaves
60	Cinchona bark	<i>Cuprea bark</i>
61	punarnava	<i>Shwet punarnava</i>
62	shankhpushpi	<i>Canscora diffusa</i>
63	Jeevaka	Guduchi
64	Ativisha	Musta
65	Rishabaka	Vamshalochana
66	Chitraka	Danti
67	Meda	Ashwagandha
68	Lakshmana	Mayurashika

69	Mahameda	Sariva
70	Pushkaramula	Kushta
71	Kakoli dwaya	Shatavari
72	Kokilaksha	Gokshura
73	Ridhhi	Bala
74	Arka dugdha	Arka swaras
75	Vrudhhi	Mahabala
76	Murva	Manjishta twak
77	Nagakesara	Padmakesar
78	Saindhava Lavana	Saamudra lavana

CONCLUSION

Among man's everyday needs, food plays a major sustaining role. From the simple dish to the most elaborate haute cuisine, food preparation is as varied and rich as man's taste. The lure of riches and general apathy towards mankind has led to adulterants being added to food from the simple stones in rice to the more harmful

brick and boric powder. Adulteration of food cheats the consumer and poses a serious risk to health. A common consumer may not have sufficient knowledge about purity and quality of food articles he consumes. So the present paper dealt with the list of adulterants that are added to the food items and herbs.

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