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ADULTERATION (*APMISHRANA*) AND SUBSTITUTION (*PRATINIDHI DRAVYA*) OF MEDICINAL PLANT: A REVIEW ARTICLE

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ABSTRACT

Ayurveda describes a variety of herbs for a range of ailments. Despite the fact that the majority of these uses are not scientific, there is growing awareness of and acceptance of the use of herbal medications in modern medicine. Raw pharmaceuticals have been adulterated and replaced as a result of species loss, deforestation, and inaccurate plant identification. As the usage of herbal goods has increased, so have the abuse and adulteration of the products, which has disappointed consumers and manufacturers and, in some cases, had disastrous results. On the other side, adulteration is producing more serious issues due to the shortage of drugs where substitution is helpful. One of the main issues with adulteration is that it makes people sceptical of the traditional system's ability to heal. Literally, adulteration is described as combining or substituting the original drug material with other fake, subpar, flawed, useless, or spoilt components of the same plant, including hazardous compounds. Substitution is generally done when original drugs are non-available or available in small quantity. Adulteration is termed as *Apmishrana* in *Ayurveda*. The methods, causes, and some typical adulterants are all thoroughly described in the current paper.

KEYWORDS: Adulteration, Substitution, *Apmishrana*, *Pratinidhi Dravya Ayurveda.*

INTRODUCTION

Ayurveda is an Indian traditional system of alternative medicine. The commerce of medicinal plant's raw materials frequently involves adulteration and substitution. Adulteration of herbs is one of the frequent frauds in the trade of herbal raw materials. The herbal industry's most pressing issue right now is the adulteration and replacement of herbal drugs. Raw medications have been adulterated and replaced as a result of the destruction of forests, the extinction of numerous species, and the wrong identification of numerous plants.[1,2]

Adulteration can also be described as combining or substituting the original drug substance with other fake, subpar, flawed, spoilt, or useless components of the same or different plants, or dangerous substances or drugs that do not adhere to the official criteria. If a substance that is dirty, putrid, or decomposing comprises even a small portion of a drug, that substance is considered to be contaminated.[3]

Adding adulterants is the practise of adulteration. A number of factors, such as additions and authorised food additives, set an adulterant apart from other compounds. In order to save money, chicory may be added to coffee; this is adulteration if not revealed but may be noted on the label. It can be challenging to distinguish between an addition and an adulterant. Bondages, both with and without declarations, should normally not be included in the scenario. Typically, the term "contamination" refers to the accidental or negligent addition of unfavourable chemicals. Cutting agents are adulterants added to illegal narcotics to reduce the amount of expensive product. In relation to *Ayurveda*, *Apamishrana* has been employed for adulteration whereas *Pratinidhi Dravya* (substitutes) has been developed for substitution.[4]

Practises of substitution and adulteration are growing daily due to the high demand, lack of natural resources, and unavailability of pure, crude drugs. Similarly, a significant portion of plants used in herbal industries are in dispute. Lack of plants and poor understanding, such as knowledge of naming plants by identifying species with partially similar or fully similar properties, inherent qualities of accent and dialects, naivety, and ignorance of the names of plants by identifying species with partially similar or fully similar properties, The herbal industry and *Ayurvedic* practises are currently challenged by the adulteration and substitution of natural medications. One of the biggest issues in the marketing of *Ayurveda* and herbal goods is the loss of trust in herbal medicines as a result of adulteration. Additionally, adulterants cause negative effects or health risks. Similar controversy is causing issues with consistency in standardisation and dependability of *Ayurvedic* goods, and because of the

usage of substitutes, it is challenging to achieve the same effects that the real pharmaceuticals may produce.[5]

The aim of this study is to define and identify the reasons for disagreement, adulterations, and substitutions on traditional and contemporary views with suitable instances, as well as their impact on *Ayurvedic* practises.

Table 1: Difference between adulterants and substitutes.

S. No.	Adulterants	Substitutes
1.	Adulteration is the intentional addition of foreign substances to increase the weight of product and to decrease its cost.	Substitute drugs are that drugs which are based on similar properties i:e *Rasa, Guna, Virya* and *Vipaka* and most important is *Karma*.
2.	In simple words- Adulteration is the debasement of an article.	Substitution is generally done when original drugs are non-available or available in small quantity.
3.	It is added partially or fully which is inferior or substandard in therapeutic and chemical properties.	*Vaidya* called substitute drugs as *Pratinidhi Dravya.*
4.	Adding low grade or spoiled drugs or entirely different drugs similar to that of original drugs.	*Acharya Charak* and *Susruta* have not given direct references but *Acharya Vagbhat* has stated about substitutes.
5.	Purpose is for enhancement of profits.	Detail description regarding substitute drugs can be traced from the text books of *Bhavaprakasha*, *Yogaratnakara* and *Bhaishajya ratnavali.*
6.	Adulterant drugs are similar to crude drugs in morphology and therapeutically but substandard in nature and cheaper in cost.	Substitution can be done by using totally different drugs species belonging to same family or different species.
7.	Adulteration is also done with artificially manufactured	

- **METHODS OF ADULTERATION**
  - Inferiority
  - Spoilage
  - Deterioration
  - Admixture
  - Sophistication

- Superficially similar Inferior drugs
- Artificially Manufactured substance
- Using of Synthetic Drugs
- Harmful Adulterants

- **TYPES OF ADULTERANTS[1]**

Drugs are generally adulterated or substituted with substandard, inferior or artificial drugs.

a) Substitution with substandard commercial varieties

Adulterants resemble the original crude drug morphologically, chemically, therapeutically but substandard in nature and cheaper in cost. This is the most common type of adulteration.

b) Substitution with Superficially similar inferior Drugs

Inferior drugs may or may not have any chemical or therapeutic value. They resemble only morphologically, so due to its resemblance they are used as adulterants.

c) Substitution with Artificially Manufactured Substance

The drug is adulterated with the substance which has been prepared artificially. The artificially manufactured substance resembles the original drug.

d) Substitution with Exhausted Drug

The same drugs are combined, but because the medicinally active component has already been extracted, it is not present. This technique is mostly used to adulterate drugs that include volatile oils including clove, coriander, fennel, and caraway. Natural colour and flavour are altered with additions because extraction renders it tasteless and colourless.

e) Substitution with Synthetic Chemicals to Enhance Natural Character

Synthetic chemicals are used to enhance natural character of the exhausted drug. Examples: citral is added to citrus oils like lemon and orange oils.

f) Presence of vegetative matter of same plant- Instead of proper used parts of crude drugs other parts of same species or miniature species grown around the large species are mixed with genuine crude drugs. For example instead of *Moola* (root) of *Bala* (*Sida cardifolia*) stem or whole parts of plant is used. This type of adulteration occurs in both intentional and unintentional adulteration.

g) Harmful adulterants - For increasing weight of crude drugs for commercial profit, some harmful substances are added with genuine crude drugs, for example stone pieces and sand particles mixed in *Guggulu* (gum of *Commiphora mukul*).

h) Adulteration of powders- The drugs which are commonly found in powder forms are

adulterated with powder of other substances resembling the same, examples are dextrin in ipecacuanha and *Kampillak* (*Malotous phillipinensis*) powder is adulterated with Annatto dye (*Bixa orellana* Linn.).

- **REASON OF ADULTERATION[6,7,8,9,10]**

Confusion in Vernacular Names: In *Ayurveda, Parpatta* refers to *Fumaria parviflora*. In *Siddha, 'Parpadagam'* refers to *Mollugo pentaphylla*. Due of their names' closeness in traditional medical systems, these two herbs are frequently mixed up, falsified, or substituted. Because of the popularity of *Siddha* medicine in some parts of South India, traders in these regions supply *Mollugo pentaphylla* as *Parpatta/Parpadagam* and the North Indian suppliers supply *F. parviflora*. These two can be easily identified by the presence of pale yellow to mild brown colored, thin wiry stems and small simple leaves of *Mollugo pentaphylla* and black to dark brown colored, digitate leaves with narrow segments of *F. parviflora*. *Casuarina equisetifolia* for *Tamarix indica* and *Aerva lanata* for *Berginia ciliate* are some other example for adulterations due to confusion in names.[6]

Lack of knowledge about Authentic Source

Nagakesar is one of the important drugs in *Ayurveda*. The authentic source is *Mesua ferrea.* However, market samples are adulterated with flowers of *Calophyllum inophyllum*. Though the authentic plant is available in plenty throughout the Western Ghats and parts of Himalayas, suppliers are unaware of it. There may also be some restrictions in forest collection. Due to these reasons, *C. inophyllum* (which is in the plains) is sold as *Nagakesar.* Authentic flowers can be easily identified by the presence of two-celled ovary whereas in case of spurious flowers they are single celled.

Similarity in Morphology

Mucuna pruriens is adulterated with other similar *Papilionaceae* seeds having similarity in morphology. *M. utilis* (sold as white variety) and *M. deeringiana* (sold as bigger variety) are popular adulterants. Apart from this *M. cochinchinensis, Canavalia virosa* and *C. ensiformis* are also sold in Indian markets. Authentic seeds are up to 1 cm in length with shining mosaic pattern of black and brown color on their surface. *M. deeringiana* and M. utilis are bigger (1.5-2 cm) in size. While *M. deeringiana* is dull black and *M. utilis* is white or buff colored.

Lack of Authentic Plant

Hypericum perforatum is cultivated and sold in *European* markets. In *India,* availability of

this species is very limited. However, the abundant *Indo-Nepal* species *H. patulum*, sold in the name of *H. perforatum*. Market sample is a whole plant with flowers and it is easy to identify them taxonomically. Anatomically, transverse section of *H. perforatum* stem has compressed thin phloem, hollow pith and absence of calcium oxalate crystals. Whereas *H. patulum* hasbroader phloem, partially hollow pith and presence of calcium oxalate crystals.

Similarity in Color

It is well known that with course of time, drug materials get changed to or substituted with other plant species. '*Ratanjot'* is a recent day example. According to the suppliers and non-timer forest product (NTFP) contractors, in the past, roots of *Ventilago madraspatana* were collected from Western Ghats, as the only source of '*Ratanjot*'. However, that has not been practiced now. It is clearly known that *Arnebia euchroma vareuchroma* is the present source.

Similarity is in yielding a red dye, *A. euchroma* substitutes *V. madraspatana*. Recently *V. madraspatana* is not found in market. Whatever is available in the market, in the name of *Ratanjot* is originated from *A. euchroma.*

Careless Collections

Some of the herbal adulterations are due to the carelessness of herbal collectors and suppliers. *Parmelia perlata* is used in *Ayurveda, Unani and Siddha*. It is also used as grocery. Market samples showed it to be admixed with other species (*P. perforata* and *P. cirrhata*). Sometimes, *Usnea* sp. is also mixed with them. Authentic plants can be identified by their thallus nature.

ADULTERATION MAY BE EVALUATED BY FOLLOWING METHODS[11]

- Morphological or Organoleptic tests
- Microscopic Evaluation
- Chemical Evaluation
- Physical Evaluation
- Chromatography
- Spectrophotometry
- Radio Immuno Assay
- Biological Evaluation

- **NEED FOR SUBSTITUTION[6, 7, 8, 9, 10, 12]**

Non-availability of the drug: Some drugs mentioned in *Ayurvedic* lexicon are not available nowadays, so those drugs are substituted by other drugs having similar therapeutic value. For example most of drugs from *Astavarga* are not easily available so those drugs are substituted by other ones e.g. *Meda* and *Mahameda* are substituted by *Shatavari*.

Uncertain identity of the drug: The drugs which are mentioned in *Ayurvedic* classics but their botanical identity is not clear those are substituted by known one e.g. for the herb *Lakshmana,* different species such as *Arlia quinquefolia, Ipomea sepiaria* etc. are considered.

Cost of the drug: *Kumkuma* (*Crocus sativus*) is more costly so it is substituted by less expensive *Kusumbha* (*Carthamus tinctorius* Linn.).

Geographical distribution of the drug: *Rasna (Pluchea lanceolata*) is used in Northern India while in southern parts *Alpinia galanga* is used as Rasana and *Vanda roxburghii* is considered as source in *Bengal*.

The adverse reaction of the drug: *Vasa* (*Adhatoda vasica*) is good *Rakta-Pittahara* (antihaemorrhagic) drug, but having abortificiant activity, so instead of this drug *Laksha* (*Lacifer lacca*), *Ashoka* (*Saraca asoka*) etc. are used in pregnant women for the same purpose.

Seasonal availability of drug- *Punarnawa* (*Boerhaavia diffusa*) is commonly not found throughout the year so for that *Trianthema portulacastrum* (*Varshabhu*) can be used as substitute, which is found throughout the year.

- **TYPES OF SUBSTITUTION[6,7,8,9,10,12]**

Substitution with totally different drug- Use of *Danti* (*Baliospermum montanum*) as a substitute of *Chitraka* (*Plumbgo zelenycum*).

Substitution of species belonging in same family – *Datura metal* is substituted by *Datura stamonium*.

Using different species having common Sanskrit name - Two types of *Gokshura* are used, they are *Tribulus terrestris* (*Laghu Gokshur*) and *Padalium murex* (*Brihat Gokshura*).

Using different parts of same plant – Instead of root of *Sida cordifolia* whole plants of *Sida cordifolia* is used.

Due to similar action- *Aamalki* (*Embelica officinalis*) is taken instead of *Bhallatak* (*Semicarpus anacardium*) for *Rasayan karma* (rejunaive action).

Table no. 2: Criteria of GMP Rules & Act under Schedules – T for ASU Drugs.[13]

Item	Section	Criteria of GMP Rules & Act under Schedules – T for ASU Drugs
Misbranded drugs	**33E**	**ASU drugs are deemed to be misbranded** • **If coloured or coated to conceal the damage or made better than therapeutic value.** • **If it is not labelled in prescribed manner.** • **If label or container accompanying drug bears any claim or misleading.**
Adulterate Drugs	**33EE**	**ASU drugs are deemed to be adulterated** • **If it consists filthy or decomposed material.** • **If prepared, packed or stored under insanitary conditions.** • **If its container contains any poisonous or deleterious substance.** • **Colour other than one which is prescribed.** • **Harmful or toxic substances.** • **If any substance mixed to reduce its quality or strength**
Spurious drugs	**33EEA**	**ASU drugs are deemed to be spurious.** **If it is sold or offered under another name.** • **If it is an imitation or substitution for another drug.** • **If the label or container bears the name of an individual or company which is factious.** • **If it has been substituted by other drug.**

DISCUSSION

Adulterants and substitutes are different. Morphology or phytoconstituents are not the most important factors for substitution; rather, pharmacological action is. To obtain a similar therapeutic effect from substitute material, herbal medications are logically replaced. Both a legal (official substitutes) and an unlawful (commercial element) understanding of substitution and adulteration are possible. The legal drug substitute possesses features that are comparable to those of the original drug, and this claim is supported by science. The term "illegal" refers to the use of a substance that is not supported by science and has been substituted for the original drug because the adulterator or drug dealer stands to profit commercially from it.

CONCLUSION

- After understanding the ways of adulteration, more research and information required to rectify and minimize the illegal act adulteration, for improving consumers' safety.

- For this purpose we can take help from scientific literature, expert opinion, pharmacology, kinetics/dynamics, interactions, adverse effects, toxicology and dosing.
- The numerous reports of adverse effects and deaths associated with botanical health products, the distribution and widespread sale of adulterated products, and the marked increase in misleading promotional claims on the Internet demand prompt action to protect the public health.
- *Naama-Roopa* (nomenclature and morphology) of drugs are clear in *Samhitas*, controversy aroused mainly due to *Nirukti* (basonyms)and *Paryaya* (synonyms) are given by different *Nighantus*.

REFERENCES

1. Kokate CK, Purohit AP, Gokhele SB., Pharmacognosy, 39th ed., Nirali Prakashan, Pune, 2007; 97-98.
2. Mukherjee PK, Quality Control of Herbal drugs. 1st ed., Business Horizons, New Delhi, 2002; 113-117.
3. The Drugs and Cosmetics Act and Rule; The Drugs and Cosmetics Act 1940; The Drugs and Cosmetics Rule 1945; Government of India, Ministry of Health and Family Welfare; Chapter 2; The Controller of Publications, Civil Lines, Delhi-110054 (Publisher); 2003, 5.
4. Pravin R Joshi, *et al* Adulteration with Special Reference to Ayurvedic Medicines, I J E P P; April - June 2018.
5. Puneshwar Keshari, Pradeep CONTROVERSY, ADULTERATION AND SUBSTITUTION - BURNING PROBLEMS IN AYURVEDA PRACTICES; IAMJ, (ISSN: 2320 5091) (July, 2017) 5(7)
6. Sarin YK. Illustrated Manual of Herbal drugs used in Ayurveda, Joint Publication of C.S.I.R and I.C.M.R, New Delhi. 1996.
7. Pravin R. Joshi, Bhupesh R. Patel1, Vinay J. Shukla2. An overview on the substitution of drugs in Ayurveda and their evaluation methods. AYU., Oct-Dec. 2012; 33(4): 481-484.
8. Poornima B, Adulteration and substitution in herbal drugs a critical analysis. IJRAP, 2010; 1(1): 8-12. 11. Dr. Poonam. Adulteration of crude drugs burning problem. International Journal of Applied Research, 2016; 2(2): 99-101.
9. Mitra S K, Kannan R. A Note on Unintentional Adulterations in Ayurvedic Herbs. Ethnobotanical Leaflets, 2007; 11: 11-15. (https://www.researchgate.net/publication /27654557)
10. Sharma PC, Yelne MB, Dennis TJ. Editors. Database on Medicinal Plants used in

Ayurveda, Vol 1. New Delhi: Central Council for Research in Ayurveda and Siddha, Reprint, 2002.

11. Prakash Hegde L. A Text book of Dravyaguna Vijnana, Chaukambha Publications, Edition, 2014; 1: 598.
12. Prachi A. Khaire, Prashant B. Nandwate. Substitutes for Ayurvedic medicinal herbs: A Review. International Journal of Recent and Futuristic Ayurveda Science, 2017; 2(1): 107- 114.
13. Ayurvedic Pharmacopia of India, Ministry of health and welfare; Department of AYUSH, New Delhi, Cirrus Graphics Pvt. Ltd; First edition.