



Review Article

PHARMACOGNOSTICAL IDENTIFICATION OF *ARJUNA*, *PUNARNAVA* AND *JATAMANSI* WITH RECAPTURE OF CONCEPT OF SUBSTITUTION AND ADULTERATION

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ABSTRACT

In recent era, growth in natural product market and interest in traditional system of medicine is seen and people are shifting towards the Ayurvedic theories of health management. But, growth in production is still linear and fast depletion of resources is creating the major trouble. To meet the deficit, practices of adulteration and substitution are used widely, which became burning problem in industry threatening the integrity of Ayurveda. **Aim and Objective:** The aim of this article is pharmacognostical identification of *Arjun*, *Punarnava* and *Jatamansi* with recapture of concept of adulteration and substitution, their cause, types, examples and other import aspects and identify areas that need further research. **Methodology:** The pharmacognostical identification of *Arjun*, *Punarnava* and *Jatamansi* was performed with their adulterant and substituent. The review of concept of adulteration and substitution was done from literature and more than 30 published research articles that were identified through a systematic search of major computerized medical databases. **Observation and Result:** The deforestation, extinction or evolution of many species, insufficient knowledge, unauthenticated practices about raw material collectively resulted in adulteration and substitution. The concept of substitution is known in Ayurveda as it is enlightened prominently in *Vagbhata*, *Bhavprakash Yogratnakar* and *Bhaishajya ratnavali*. The pharmacognostical identification of *Arjun*, *Punarnava* and *Jatamansi* was performed and shown with their adulterant and substituent. **Discussion:** Strategic planning and integrated approach towards mass production, supply chain management, IEC, proper advocacy, proper pharmacovigilance monitoring of raw materials and knowledge sharing is needed to trim down the gravity of adulteration. Scope of this article throws light on the concepts of substitution given by our preceptors and analyses these with the present-day prevailing trend of adulteration and substitution.

INTRODUCTION

Today the Ayurvedic Medical science is a Global science, many people are shifting towards herbal medication and Ayurvedic therapy. This is leading to exponential increased demand of Ayurvedic medicines. Herbal adulteration and substitutions are one of the common malpractices in herbal raw

material trade, which may cause hazardous effects or the drug may be ineffective too, landing in integrity of Ayurveda becomes questionable. The drugs which are morphologically similar and cannot be distinguished easily are generally adulterated and substituted. In ancient time the quality of medicine was optimum as the section of raw materials and preparation of drugs was under direct supervision of physician. However, in recent period this tradition became unfeasible and constantly declining, reviews suggest some of the possible reasons for his depreciation.

- Change in lifestyle and practicing way and of physicians and beneficiaries.
- Exponential multiplication in demand of raw materials.

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- Decreased production due to deforestation, urbanization, less cultivation.
- Lack of awareness and unauthenticated practices about identification, collection, storage and transport of raw material.
- Climate change leading to extinction or evolution of species.

Adulteration and substitution may be involved offering one substance in place of another more expensive or substance that might not be readily available at given prizes.^[1] Aware of constrain, many substitute drugs are mentioned in Ayurvedic classics. The principles to selection of substitute drugs are based on similarity of basic properties (*Rasa, Guna, Vipaka, Virysa*) and importantly the *Karma* i.e., the therapeutic action of the drug. Substitution is generally used when original drugs are available in very small quantity or completely not available. It is also explained in Ayurvedic texts that the drugs which are not available or less available were replaced by other drugs called as substitute drugs (*Pratinidhi dravyas*).

AIM AND OBJECTIVES

The aim of this article is pharmacognostical identification of *Arjun, Punarnava* and *Jatamansi* with recapture of concept of adulteration and substitution, their cause, types, examples and other import aspects and identify areas that need further research.

MATERIALS AND METHODS

Pharmacognostical Study

It was carried out by naked eye and magnifying lens as organoleptic study for color, odor, taste, texture of *Arjun, Punarnava* and *Jatamansi* and compared with other adulterant and substituent. This review of

concept of adulteration and substitution was done from literature and more than 30 published research articles that were identified through a systematic search of major computerized medical databases.

RESULTS AND OBSERVATIONS

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.^[2,3]

Adulteration may also 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. A drug shall be deemed to be adulterated if it consists, in whole or in part, of any filthy, putrid or decomposed substance.^[4]

Many researchers have contributed in checking adulterations and authenticating those. It is invariably found that the Adverse Event Reports are not due to the intended herb, but rather due to the presence of an unintended herb.^[5,6,7,8,9,10,11,12]

Adulteration may take place broadly by two ways:

- **Deliberate adulteration:** It is also known as Direct Adulteration or Intentional Adulteration.
- **Undeliberate adulteration:** It is also known as Indirect Adulteration or Un-intentional Adulteration.^[13]

Table 1: Reasons for Adulteration ^[14,15]

S.No.	Reason	Example
1.	Faulty collection	<i>Aconitum deinorrhizum</i> may be collected in place of <i>Aconitum napellus</i>
2.	Imperfect preparation	Stems are collected with leaves
3.	Incorrect storage	<i>Cascara sagrada</i> bark should be collected at least 1 year before being used
4.	Gross substitution by plant material	Barks of <i>Treena orientalis</i> Blume often offered as <i>Ashoka</i>
5.	Adulteration with non-plant materials	Clove and Caraway adulteration by imitation material made of clay, artificial catechu made of clay
6.	Partial adulteration with other plant materials	Leaves of <i>Digitalisthpsi</i> with <i>D. purpurea</i>
7.	Substitution of exhausted drug	Exhausted ginger and liquorice are often mixed with genuine drugs
8.	Confusion in vernacular names	<i>Parpatta</i> refers to <i>Fumaria parviflora</i> (Ayurveda) and <i>Mollugo pentaphylla</i> (Siddha)
9.	Lack of knowledge about authentic plant source	<i>Mesua ferra</i> is adulterated with flowers of <i>Calophyllum indophyllum</i> .
10.	Morphological similarity	<i>Mucuna pruriens</i> is adulterated with other similar Papilionaceae seeds

11.	Lack of authentic plant	<i>Hypericum perforatum</i> is cultivated and sold in European markets but limited in India.
12.	Careless collection of raw materials	<i>Shaileya (Pamelia perlata)</i> herb is most commonly mixed with other species (<i>P.Perforata</i> and <i>P.Cirrhata</i>).

Table 2: Type of Adulterants [16]

S.No.	Type	Adulterant	Example
1.	Adulteration with standard commercial varieties	Resemble morphologically, chemically and therapeutically, the original crude drug, but they are below standard and cheaper in cost.	<i>Nux vomica</i> seeds are adulterated with <i>Strychnos nux-blanda</i> or <i>Strychnos potatorium</i> seed.
2.	Adulteration with superficially similar but inferior Drugs	Inferior drugs resemble the original drug only morphologically but not chemically and therapeutically.	Saffron with dried flowers of <i>Carthamus tinctoria</i> (safflower).
3.	Adulteration with exhausted drugs	Devoid of colour and taste due to extraction, natural colour and taste is manipulated by additives.	Clove, coriander and fennel.
4.	Adulteration with artificially manufactured substances	Observed in case of drugs which are very costly.	Paraffin wax is adulterated with yellow bee's wax.
5.	Adulteration with synthetic chemicals to enhance Natural characters	Synthetic chemicals which are used to enhance natural character of the drug.	Citral is added to citrus oils like orange and lemon oils.
6.	Substitution by powders	The drugs which are in powdered form is most frequently adulterated.	Powdered bark of the drugs adulterated with brick powder.

Substitution

The drug used during non-availability of original drug is known as substituent. It may have the same type of physiological active constituents. The percentage of quality of the drug available may be different. Substitution occurs when a totally different substance is added in the place of original drug.^[17]

Table 3: Reasons for Substitution [18,19]

S.No.	Reason	Example
1.	Non-availability of the drug	<i>Astavarga dravyas</i>
2.	Cost of the drug	<i>Kumkum</i> being costly drug can be substituted by <i>Kusumbha</i>
3.	Adverse reaction of the drug	<i>Vasa</i> having abortifaciant activity is limited for pregnant women besides, <i>Ashoka</i> can be substituted
4.	Shelf life of the drug	Non-availability of old jaggery, new jaggery after heating in sun rays for four hours can be used
5.	Uncertain identity of the drug	Herb <i>Lakshmana</i> and different species such as <i>Aralia quinquefolia</i> and <i>Ipomea sepiaria</i> etc are considered
6.	Seasonal availability of drugs	<i>Trianthema portulacastrum</i> can be used in seasonal absence of <i>Boerhavia diffusa</i>

Table 4: Types of Substitution [20]

S.No.	Type	Example
1.	Substitution with a totally different drug	<i>Bharangi (Clerodendron indicum)</i> and <i>Kantakari (Solanum xanthocarpam)</i> are commonly used as a substitute for one another in respiratory diseases
2.	Substitution with species belonging to the same family	<i>Datura metal</i> is generally substituted by <i>Datura stramonium</i>
3.	Substitution with substances belonging to different species	<i>Laghu Gokshur - Tribulus terrestris (Zygophyllaceae)</i> and <i>Brihat Gokshura - Padalium murex (Pedaliaceae)</i> used alternatively
4.	Substitutions with different	Whole plant of <i>Sida cordifolia</i> instead of roots of <i>S. cordifolia</i>

	parts of the same plant	
5.	Substitution with substances having similar action	<i>Amalaki (Emblca officinalis)</i> can be taken instead of <i>Bhallatak (Semicarpus anacardium)</i> for <i>Rasayan karma</i>

Substitution in Ayurveda: The concept of substitution is known in Ayurveda as it is enlightened prominently in *Vagbhata*^[21], *Bhavprakash*^[22], *Yogratnakar*^[23] and *Bhaishajya ratnavali*^[24]. However, in scenario of crises, selection of substitute drugs may have upper edge over adulteration of the raw material.

Pharmacognostical Identification

Table 5: Pharmacognostical identification of *Arjun*, *Punarnava* and *Jatamansi*^[25,26,27,28]

S. No.	Common Name	Botanical Name	Substitute	Botanical Name
1	<i>Arjuna</i>	<i>Terminalia arjuna</i>		<i>Terminalia alata</i> , <i>Terminalia bialata</i> , <i>Terminalia belliricia</i> , <i>Terminalia myriocarpa</i> , <i>Terminalia catappa</i>
			<i>Jarula</i>	<i>Lagerstroemia speciosa</i>
2	<i>Punarnava</i>	<i>Boerhavia diffusa</i>	<i>Varshabu</i>	<i>Trianthema portulacastrum</i>
3	<i>Jatamansi</i>	<i>Nardostachys jatamansi</i>	<i>Tagarh</i>	<i>Valeriana wallichii</i>
			<i>Bhutkeshi</i>	<i>Selinum vaginatum</i>

Arjun

Sanskrit name: *Arjuna*

Botanical name: *Terminalia arjuna* (Roxb.)

Family: Combretaceae

Part used: Bark

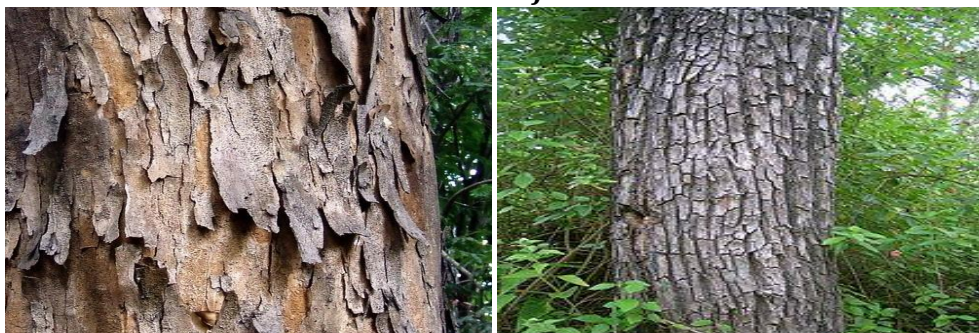
Table 6: Pharmacognostical Characters of *Terminalia arjuna* sample

S.No	Macroscopic study	<i>Terminalia arjuna</i>
1	Colour	Light Brown
2	Odour	characteristic
3	Taste	Astringent

Table 7: Macroscopic Characters of *Terminalia arjuna* and *Terminalia alata*

S.No.	<i>Terminalia arjuna</i>	<i>Terminalia alata</i>
1.	Bark-Pale Externally- Flesh coloured Internally- Smooth, flaky Taste- Bitter	Bark-Externally- Rough showing cracks and fissures Internally- Dark brown to black and smooth Taste- Astringent

Picture 1: Bark of *Terminalia arjuna* and *Terminalia alata*



Punarnava

Sanskrit name: *Punarnava*

Botanical name: *Boerhavia diffusa*

Family: Nictaginaceae

Part used: Whole plant

Table 8: Pharmacognostical Characters of *Boerhavia diffusa* sample

S.No	Macroscopic study	<i>Boerhavia diffusa</i>
1	Colour	Light Brown
2	Odour	Characteristic
3	Taste	Sweet Bitter

Table 9: Macroscopic Characters of *Boerhavia diffusa* and *Trianthema portulacastrum*-

S.No.	<i>Boerhavia diffusa</i>	<i>Trianthema portulacastrum</i>
1.	<p>Root- Yellowish to dark brown, 20cm in length, 2cm in diameter with occasional branches, longitudinally wrinkled and fissured surface.</p> <p>Stem- Greenish-purple, spreading with swollen nodes.</p> <p>Leaf- simple, opposite, petiolate, thick, ovate to orbicular with size varying 2 to 4cm in length, 1.5 to 3cm in width, with round apex and subcordate base; upper surface green and lower silvery white.</p> <p>Flower- Pink very small, in long pedunculated umbels which are both axillary and terminal, bracteates, epigynous with fused cup-shaped perianth lobe, stamens 5, ovary inferior.</p>	<p>Root - Light yellow on the surface, creamish white inside, tapering fibrous with lateral branching, 5 to 15cm in length, 0.3 to 2.5cm in diameter</p> <p>Stem- Cylindrical, dichotomously branched with reddish tints at places and swollen nodes.</p> <p>Leaves- Entire, wavy with reddish and papillose border, sub-fleshy, larger leaves obovate to obcordate, 2 to 2.3cm, the smaller one rounded or apiculate at the apex, 10.2 to 6mm long, petiolate dilated into a membranous pouch at the base, slightly hairy.</p> <p>Flower- Small, solitary, sessile, pinkish, nearly concealed by the pouch of the petiole, calyx tube scarious, thin, stamens 10 to 15, ovary superior, sessile, style single papillose, shorter than stamens.</p>

Picture 2: Parts of *Boerhavia diffusa* and *Trianthema portulacastrum***Jatamansi**Sanskrit name: *Jatamansi*Botanical name: *Nardostachys jatamansi*

Family: Valerianaceae

Part used: Rhizome

Table 10: Pharmacognostical Characters of *Nardostachys jatamansi* sample

S.No	Macroscopic study	<i>Nardostachys jatamansi</i>
1	Colour	Dark red
2	Odour	Characteristic
3	Taste	Bitter

Table 11: Macroscopic Characters of *Nardostachys jatamansi*, *Valeriana wallichii* and *Selinum vaginatum*

S.No.	<i>Nardostachys jatamansi</i>	<i>Valeriana wallichii</i>	<i>Selinum vaginatum</i>
1.	Rhizome-2-10cm long. 1.5 cm thick, densely covered with silky reddish brown tufted fibrous remain. Taste- Slightly bitter	Rhizome-2.5-12cm long. 3.5 cm thick, covered with thick brownish rootlets. Taste- Bitter and slightly camphoraceous.	Rhizome-10-15cm long. Covered with tuft of brittle hairs on each end. Taste- Bitter and slightly camphoraceous.

Picture 3: *Nardostachys jatamansi*, *Valeriana wallichii* and *Selinum vaginatum***DISCUSSION**

Organoleptically color, odor and taste of samples of *Arjun*, *Punarnava* and *Jatamansi* examined and compared with substituent and adulterants. Samples are organoleptically within the limits.

Substitution of the herbs is prevalent with more than 300 medicinal plants becoming red listed. There is enormous commendable work being published in various journals about adulteration and substitution. Reviewing the analysis draws results about challenges and opportunity-

- Strategic planning and integrated approach towards mass production.
- Supply chain management
- Suppliers and traders should be educated about the authentic sources.
- Knowledge sharing is needed to trim down the gravity of adulteration.
- Use of monographs available and various regulatory guidelines including W.H.O. guidelines have to be followed.
- Proper advocacy & proper pharmacovigilance monitoring of raw materials.
- Using modern techniques and instruments to maintain their quality.
- Based on W.H.O. standards, adulteration whether, intentional or unintentional, should be rejected.
- Scope of this article advocates that how adulteration and substitution are creating problems with respect to production of inferior quality medicines. It throws light on the concepts of substitution given by our preceptors and analyses

these with the present-day prevailing trend of adulteration and substitution.

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