CURRENT SCENARIO OF ADULTERANTS AND SUBSTITUTES OF MEDICINAL PLANTS: A REVIEW
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ABSTRACT

Medicinal plants constitute an effective source of traditional and modern medicine. In India, about 80% of the rural population depends on medicinal plants and indigenous system of medicine for primary health care. Adulterants and substitutes are the common malpractices in herbal raw material trade. Adulteration is considered as an intentional addition of foreign substances to increase the weight of the product or to decrease its cost. It may be due to confusion in vernacular names, lack of knowledge about authentic plants, non availability, similarity in morphology, activity, aroma, careless collection and other unknown reasons. Many Substitutes are mentioned in Ayurvedic texts. In the present article, an attempt has been made to document the list of adulterants and substitutes of the ayurvedic drugs that are currently available and sold in the world market.

Key words: Ayurveda, Adulteration, Substitute drug, Market.

INTRODUCTION

Ayurveda is a system of Indian traditional form of alternative medicine. Adulteration and Substitution are frequent in raw material trade of medicinal plants. Herbal adulteration is one of the common malpractices in herbal raw material trade. At present the adulteration and substitution of herbal drugs is the burning problem in herbal industry. The deforestation and extinction of many species and incorrect identification of many plants has resulted in adulteration and substitution of raw drugs. The term adulteration of an article covers a number of conditions which may be intentional or accidental. It is a practice of adding foreign substance in place of original crude drug partially or fully which is inferior or substandard in therapeutic and chemical properties or addition of low grade or spoiled drugs or entirely different drug similar to that of original drug adding which an intention of enhancement of profits. Due to adulteration, faith in herbal drugs has declined. Adulteration in market samples is one of the greatest drawbacks in promotion of herbal products. In adulterated drugs, 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. Medicinal plant dealers have discovered the scientific methods in creating adulteration of such a high quality that without microscopic and chemical analysis, it is very difficult to trace these adulterations. Many substitute drugs are mentioned in Ayurvedic texts. The principles to select substitute drugs is based on similarity of properties (Rasa, Guna Virya and Vipaka) but most important factor is therapeutic action (Karma). In terms of pharmacy, substitute is generally used when original drugs are not available or may be available in small quantity. In ancient time, Vaidya had to collect the drug by own. The drugs which were less available in local area were replaced by other drugs known as substitute drugs (Pratinidhi Dravyas).

Difference between Adulterants Substitutes

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Adulterant</th>
<th>Substitute</th>
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<tbody>
<tr>
<td>1.</td>
<td>Adulteration is the intentional addition of foreign substances to increase the weight of product and to decrease its cost.</td>
<td>Substitute drugs are that drugs which are based on similar properties i.e Rasa, Guna, Virya and Vipaka and most important is Karma.</td>
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<td>2.</td>
<td>In simple words: Adulteration is the debasement of an article.</td>
<td>Substitution is generally done when original drugs are non-available or available in small quantity.</td>
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<tr>
<td>3.</td>
<td>It is added partially or fully which is inferior or substandard in therapeutic and chemical properties.</td>
<td>Vaidya called substitute drugs as Pratinidhi Dravya.</td>
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<td>4.</td>
<td>Adding low grade or spoiled drugs or entirely different drugs similar to that of original drugs.</td>
<td>Acharya Charak and Susruta have not given direct references but Acharya Vagbhat has stated about substitutes.</td>
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<tr>
<td>5.</td>
<td>Purpose is for enhancement of profits.</td>
<td>Detail description regarding substitute drugs can be traced from the text books of Bhuavaprakasha, Yogaratnakara and Bhaisajyaratnavali.</td>
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<td>6.</td>
<td>Adulterant drugs are similar to crude drugs in morphology and therapeutically but substandard in nature and cheaper in cost.</td>
<td>Substitution can be done by using totally different drugs species belonging to same family or different species.</td>
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List of Medicinal plants\textsuperscript{13,14}

**Bilva (Aegle marmelos)**
Bael fruits are often substituted with wood apple (Feronia limonia) and mangosteen (Garcinia mangostana)

**Bharangi (Clerodendrum serratum)**
Clerodendrum serratum and Clerodendrum indicum, both are used as Bharangi. Bark of Gardenia turgida is reported to be sold as Bharangi bark. Picrasma quassioides is used as Bharangi in Bengal.

**Chitraka (Plumbago zeylanica)**
Plumbago indica commonly known as Rakta chitraka is used for same condition as Plumbago zeylanica

**Danti (Baiiospermum monutatum)**
The vernacular names of Baiiospermum montanum, Croton tiglium and Jatropha curcas are confused with each other in most districts of India. They are often sold in the market under the name of Jamalgota. The root of Danti is sometimes used as a substitute for Croton tiglium

**Daruharidra (Berberis aristata)**
Curcuma longa is sometimes used as a substitute. Berberis lycium and Berberis asiatica are also used in medicine as Daruharidra. In South India and Sri Lanka, Cascinium fenestratum is known and used as Daruharidra.

**Gunja (Abrus precatorius)**
Root of Gunja has been used a substitute for Yashtimadhu.

**Kapikacchu (Mucuna prurita)**
Mucuna utilis are often sold in the market in the name of Kapikacchu.

**Arka (Calotropis procera)**
Calotropis procera and Calotropis gigantea are often used as substitute for one another.

**Vijaysaar (Pterocarpus marsupium)**
Terminalia tomentosa is often used as a substitute. Dried juice of Butea monosperma trunk is called Bengal kino and is used as adulterant and substitute of Indian kino.

**Madyantika (Lawsonia inermis)**
Henna powder id often adulterated with organic and inorganic articles like sand, stems and fruits of Henna plant and husks of paddy (Oryza sativa), arhar (Cajanus cajan) and Moong (Vigna mungo)

**Naagkesar (Messua ferra)**
Calophyllum inophyllum, Cinnamomum wightii and Myristica fragrans are sold as substitute for Messua ferra). In the markets of Gujarat and Bombay, Ochrocarpus longifolius are sold in the market in the name of Ratn Nagkesar. Unripe fruits of Cinnamomum tamala and C. wightii are sold as Kala Nagkesar.

Nagkesar sold in Bazars of South India is reported to be fruits of Dillenia pentagyna (Malabar Nagkesar).Natu Nagkesar used by Siddha/ Tamil Vaidyas resembles to Cinnamomum wightii. Buds of Mammea sewiga and Calophyllum inophyllum are reported be used as adulterants.

**Rakta Punarnava (Boerhavia diffusa)**
Market samples of Rakta punarnava are often adulterated with Trianthea portulacastrum.

**Saariva (Hemidesmus indicus)**
Three species Cryptolepis buchanani, Decalepis hamilontonii and Ichnocarpus frutescens are used as substitutes due to non availability of Hemidesmus indicus.

**Shatavari (Asparagus racemosus)**
Roots of Asparagus sarmentosus, A. cirsulus, A. filicinus and A. sprengeri are also being sold in the name of Shatavri.

**Sthula Ela (Amomum subalatum)**
Common adulterant in South India is Heracleum rigens. Peucedanum grande is reported to be used instead of A.subalatum as Sthula Ela in Kerala. A. dealbatum seeds are reported to be used as substitute for true large cardamomum seeds.

**Vacha (Acorus calamus)**
Alpinia officinarum and Alpinia galanga are adulterant of Vacha.

**Vaasa (Adhatoda vasica)**
Adhatoda beddomei is commonly used as substitute in Kerala. Ailanthus excels is a common adulterant of Vaasa leaves.

**Agnimantha (Clerodendrum phlomidis)**
In Ayurveda Formulary Of India Part – I, Clerodendrum phlomidis has been accepted as Agnimantha; whereas Premna macronata and Premna integrifolia are considered as substitutes.

**Bakuchi (Psoralea corylifolia)**
Bakuchi seeds are often substituted with Cassia tora seeds.

**Bhrngaraj (Eclipta alba)**
Wedelia chinesis known as Peeta Bhrngaraj is used as substitute to Eclipta alba.

**Chakramarda (Cassia tora)**
Cassia occidentalis is sometimes used as a substitute for Cassia tora. Cassia tora seeds are used as a substitute for coffee.

**Guggulu (Commiphora mukal)**
Gum resin of C. mukal is common adulterant to C.myrrha. Indian adulterant of gum resin of Commiphora wightii are gums of Boswellia serrata, Hymenodictyon excelsum, Commiphora roxbhurgii and Commiphora opobalsamum.

**Jyotishmati (Celastrus paniculatus)**
Clove oil is used as a substitute for Celastrus Oil.
Kutaj (Holarrhena antidysenterica)

Wrightia tinctoria and Wrightia tomentosa are used as adulterants. Anilanthus excels are good substitute for H. antidysenterica. H. antidysenterica is used as a substitute for Cephalis ipecacuanha and its seeds are sold in market as adulterant of Strophanthus seeds.

Musta (Cyperus rotundus)

Cyperus scarious and C.arundinaceae are used as a substitute.

Pippali (Piper longum)

The fruiting spikes of Piper longum are often adulterated with Piper peepuloides, Piper retrofractum and Piper beetle.

Vata (Ficus bengalensis)

The powder prepared from F. bengalensis is used to adulterate Kampillaka (Mallotus philipinensis)

Yashtimadhu (Glycyrrhiza glabra)

Roots of G. uralensis and Abrus precatorius are often adulterated with liquorice.

Arjuna (Terminalia arjuna)

Stem bark of Lagerstroemia speciosa is reported to be an adulterant of Terminalia arjuna. It is also reported that bark of several other species of Terminalia are being sold indiscriminately under the name Arjuna; Terminalia bialata, T.bellirica, T.alata, T.myriocarpa, T.catappa. The bark of T.alata is also used as an adulterant to T.arjuna

Ashoka (Saraca asoca)

Polyalthia longifolia goes by the same name Ashoka and is often used as an adulterant or as a substitute of genuine Ashoka (Saraca asoca). There are few more plants viz. Bauhinia variegata, Trema orientalis and Shorea robusta; the barks of which are sold in drug market under the name of Ashoka.

Ashwagandha (Withania somnifera)

It is used as a substitute for Kakoli and Kshirkakoli of Ashtavarga which are identified as Zilium polyphllum, Fritillaria roylei as Ayurvedic Formulary of India published by Govt. Of India.

Bibhitaka (Terminalia bellirica)

The bark of T.bellirica is used as adulterant to bark of Terminalia arjuna. The fruits of T. bellirica are reported be used as a substitute in tanning industry for Terminalia chebula.

Chandan (Santalum album)

The wood of Erythroxylum monogynum is perfumed and is reported to be used as adulterant for Sandalwood. Cheaper materials like polyethylene glycol and dicotyl phthalate and other colourless high boiling oils are used to adulterate sandalwood oil.

Ashwatha (Ficus religiosa)

The stem or root of F.religiosa is employed as a substitute for Soma (Ephedra gerardiana)

Gokshur (Tribulus terrestris)

The fruits of Pedalium murex are occasionally substituted to T. Terrestris being considered as large Gokharu. The fruits of Acanthospernum hispidum resemble to cocci of Tribulus are frequently mixed with later.

Haridra (Curcuma longa)

Haridra is a substitute for Daruharidra.

Trivutta (Operculina turpeth)

The drug available in the market in the name of Safed Nishotha consists of roots of Marsdenia tantiacissima. Besides these some other rhizomes, roots other than those of Operculina are reported to be sold in the market under the name of Nishotha eg. Argyrea speciosa. Stem pieces of O. Turpethum are reported to be sold as Black Nishoth.

Krushna Saariva (Cryptoplepis buchanani)

It is used as a substitute to H. Indicus. Icnocarpus frutescens is used as Krushna Saariva in Kerala & South India.

Madanphal (Randia spinosa)

Fruit pulp is a valuable emetic and is used as a substitute for Cephalis ipecacuanha

Mahanimba (Melia azedarakh)

It is used as a substitute to Azadirachta indica.

Paaribhadra (Erythrina variegata)

Erythrina suberosa and Erythrina stricta are reported to be used as substitute for Erythrina variegata

CONCLUSION

Substitution of the herbs is the need of the hour with more than 300 medicinal plants becoming red listed. It has provided greater scope for the physician to utilize herbs that are easily available, cost effective and most appropriate for the clinical condition. It is not that all adulterations are intentional malpractice as stated in many literatures. With our experience it is noted that the herbal drugs are adulterated unintentionally also. Suppliers are illiterate and not aware about their spurious supply. Major reasons are confusion in name, non availability and lack of knowledge about authentic plant. Even scientific community and traditional physicians are unaware of it. Nowadays, Ayurvedic drug industries follow high quality standards using modern techniques and instruments to maintain their quality. World Health Organization (WHO), in its publication on quality standards for medicinal plant materials, recommends rejecting any batch of raw material, which has more than 5% of any other plant part of the same plant (e.g. stem in leaf drugs), never the less if they are derived from the authentic plant. Based on these standards, adulteration whether, intentional or unintentional, should be rejected. Also, suppliers and traders should be educated about the authentic sources.
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