

Adulteration and Substitution in Siddha Medical System: An Overview

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ABSTRACT

Siddha Medicine is a system of Indigenous Medicine in Srilanka. Siddha Toxicology (Nanjiyeal) is very important part that is dealt with plant, animal, metal and minerals poison. According the Siddha philosophy everything found in nature has good and bad qualities (Nalvinai and Theevinai). With these ideas Adulteration and Substitution are very important part of Toxicology. Because in 20th and 21 century due to side effects of synthetic drugs, there is an increasing interest in Siddha proprietary medicines. In an International survey, herbal medicines were found to be used by approximately 70% of all over the world to maintain health. The Adulteration and Substitution of herbal drugs is the burning problem in Siddha Medicine and it has caused a major effect in the commercial use of natural products. The deforestation and extinction of many species and incorrect identification of many plants has resulted in Adulteration and Substitution of raw drugs. The future development of analysis of herbs is largely depended upon reliable methodologies for correct identification, standardization and quality assurance of Siddha drugs. Adulteration may be evaluated by Morphological or Organoleptic tests, Microscopic Evaluation, Chemical Evaluation, Physical Evaluation, Biological Evaluation and Analytical methods. This review throws light on the concepts of substitution given by our preceptors and analyses these with the present day prevailing trend of adulteration and substitution.

Keyword: Siddha medicine; Siddha toxicology; Adulteration; Substitution; Herbs.

1. Introduction

Siddha Medicine is one of the oldest forms of healthcare system in Srilanka and India. Siddha Toxicology (Nanjiyeal) is very important part that is dealt with plant, animal, metal and minerals poison. According the Siddha philosophy everything found in nature has good and bad qualities (Nalvinai and Theevinai). With these ideas Adulteration and Substitution are very important part of Siddha Toxicology. Nowadays, Siddha 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 Journal of Medicinal Plants Studies Vol.1, No. 4, 2013 www.plantsjournal.com, Page 132 rejected. Adulteration is the debasement of an article and an adulterant resembles the genuine drug in respect to its morphological appearance. Substitution is the addition of an entirely different article in place of that which is required.

Reasons for Adulteration are Scarcity of the drug, the high price of the drug in the market (Clove, Cinnamon, and Cardamom), common with the contraband drug, Poor storage condition, Faulty collection of the drug.

1.1. Siddha Types of Adulteration

- (i) Adulteration of Herbal materials (தாவரச் சரக்குகளின் கலப்படம்)
- (ii) Adulteration of Minerals and metals (தாது சரக்குகளின் கலப்படம்)
- (iii) Adulteration of Animals (ஜீவ சரக்குகளின் கலப்படம்)

1.2. Types of Adulteration

1.2.1. Deliberate Adulteration/ Direct Adulteration/ Intentional adulteration

It 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. 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.

(a) Artificially Manufactured Substances

The drug is adulterated with substance which has been prepared artificially.

Eg: Properly cut, shaved Basswood – For nutmeg.

Yellow coloured paraffin wax for Bees wax.

(b) Using of Synthetic Drugs

Synthetic chemicals are used to enhance natural character.

Eg: Citral is added to citrus oils (like oil of lemon and oil of orange).

(c) Superficially Similar but Inferior Drugs

Inferior drugs may or may not have any chemical or therapeutic value.

Eg: Piper nigrum adulterated with Carica papaya.

Bee wax adulterated with Japan wax.

Belladonna leaves adulterated with Ailanthus leaves.

Crocus sativus adulterated with Carthamus tinctorius.

(d) Harmful Adulterants

Sometimes waste from the market are collected and admixed with the authentic drug.

Eg: Limestone in Asafoetida.

Mentanil Yellow in Turmeric powder.

Lead shot in Opium.

Addition of rodent faecal matter in Cardamom seed.

Argemone seed in Mustard seed.

White oil in coconut oil.

1.2.2. Accidental Adulteration/ Un – Intentional Adulteration/ Indirect Adulteration

Unintentional or un- deliberately 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.

(a) Faulty collection of crude drugs

Collection of the drug from the correct identified plant but done improper time of collection.

That is the drug might not be collected during the right season, proper age, correct stage of development.

- Season - Certain drugs are collected in specific season only, if not then the concentration of chemical constituents may be vary.

Wild cherry bark – autumn;

Male fern – Late autumn;

Solanaceous leaves – Summer;

Cinnamon bark – Rainy season;

Colchicine – Summer;

Rauwolfia – Autumn;

Ephedra – Autumn.

- Age – the chemical constitution reach their peak at a certain age.

Curcuma longa – 9 months;

Alphinia officinarum – 10 months;

Holarrehna antidysentrica – 8-12 years;

Rauwolfia – 4 years;

Belladonna Root – 3-4 years;

Rhurbarb – 6-10 years;

Santalum alba – 20 years;

Cedrus deodara - 900 years.

- Stage of Development –

Euginia caryophyllus – bud;

Szygium aromaticum – bud;

Linseed – When fully ripen;

Coriander – When fully grown;

Solanaceous leaves – Flowering stage;

Opium – capsules Maturing stage;

Wild cherry bark – Young stems;

Pyrethrum – partially opened flowers;

Umbelliferous – ripe dried fruits;

Swertia chiretta – flowering stage;

Cannabis – fall in resin content.

(b) Imperfect preparation

While preparation of crude drugs it should be considered the step of collection which reflects the economical state.

Adulteration may takes place by collection of undesirable and inert part instead of desired part.

Eg: Ipecac Roots & rhizomes Arial stem.

Fennel fruit undeveloped fruit.

Saffron Style & stigma tops Parts of corolla.

Ginger Rhizome Curt Pyrethrum Flower heads Steam & leaf.

(c) Improper drying

Faulty inadequate drying may cause adulteration.

(d) Drug storage condition

Volatile oil in closed container stored in dark room.

Eg: Cod liver oil Stored in ambered colored bottles.

Coffee Avoid overheating.

Ergot Protected from moulds.

(e) Improper storage and maintenance

Storage conditions also affect the quality of drug. Improper storage may leads to spoilage: Drug faulty treatment of drying Digitalis leaves when leaves dried enzyme degrades the glycosides content Corn of colchicum above 65°C temp, hydrolyses.

1.3. Methods of Adulterations

Methods of Adulterations are Inferiority, Spoilage, Deterioration, Admixture, Sophistication, Superficially similar Inferior drugs, Artificially Manufactured substance, Using of Synthetic Drugs and Harmful Adulterants. Confusion in vernacular names, Lack of knowledge about authentic sources, Similarity in Morphology, Lack of

authentic plants, unscientific collection, With the intention of enhancing profits, Scarcity of the drug, high price of the drug in the market, very common with the contraband drug are some reasons for adulteration.

Inferiority

Replacement with substandard drug. Natural substandard condition, where a crop is taken whose natural constituents is below the minimum standard for that particular drug.

Adulterants

Resembles the original crude drug morphologically, chemically, therapeutically but are substandard in nature and cheaper in cost.

Eg: Strychnos nux-vomica adulterated with Strychnos potatorum;

Indian senna adulterated with Arabian-senna;

Zingiber officinalis adulterated with Japanese ginger;

Solanum xanthocarpum adulterated with Solanum mammosum.

Spoilage (Attack of Microbes)

Sub-standard condition produced by microbial or other pest infestation which makes a drug unfit for medicinal preparation.

Eg: *Ativisha, Vatsanabha and Vacha*

It can be avoided by giving more careful attention to the drying & storage conditions.

Deterioration

It is an impairment of the quality of an article due to destruction of valuable constitution & the sale of the residue as the original drugs. Refer to any impairment of the quality or value of a drug due to destruction or abstraction of valuable constituents by some physical processes. Same drug is admixed but that drug is devoid of medicinally active substance as it has been already extracted. Mainly volatile oil containing drugs like Fennel, Clove, and Coriander are adulterated by this method.

Admixture

Refers to addition of one article to another through accident, ignorance or carelessness. A part of same plant which is devoid of therapeutic action is mixed.

Eg: Stem portions are mixed along with leaf in drugs like –*Bala; Dhatura*

Inclusion of soil and stone pieces in *Hingu, Sariba* root with adhering soil and other plants. Clove is mixed along with leaves and petioles.

Sophistication

Means addition of spurious or inferior material to an article with an intent to defraud. The drugs which are in the form of powders are frequently adulterated by this method.

Eg: Addition of wheat flour to powdered ginger, with enough capsicum to restore the pungency & curcuma to maintain the colour; Powdered bark adulterated with brick powder.

1.4. Methods of Substitution

Substitution with inferior quality

Ideal properties of substituent. It shows similar morphology with crude drug. It should be cheaply available. Nontoxic in nature. Compatible with crude drug.

Eg: Indian senna with Arabian senna.

Dog senna with Gentian Picrorrhiza.

Curroa Tragacanth with Hog Tragacanth.

Trichunous nuxvomica with Trichunous nuxblenda and Strichunous nuxblenda.

Substitution with exhausted crude drugs

Many drugs are extracted in large scale for the isolation of active constituent. Extraction process may not change morphology of drug. And the extracted drug is called exhausted drug. There is a chance to adulterate crude genuine drug with it.

Eg: Clove oil With clove stem oil.

Coriander Oil from fruits Cinnamon Oil from leaves.

Peppermint oil Cornmint oil.

Substitution with similar morphology

In this type drugs are adulterated with similar morphology containing drug.

Eg: Saffron Dried flowers of cartnalous tinctoris.

Myrrh Sented bedilum Clove Clove stocks.

Tragacanth gum Streculia gum Stromonium Leaves of xanthium.

Bees wax Japanese wax.

Substitution with artificially manufactured substances

Some artificial agents are manufactured to get adulteration with crude drugs. Substitution with harmful substances. In this method defective and harmful substances are admixed with unorganized drugs.

Eg: Bees wax Yellow paraffin.

Honey Invert sugar.

Coconut oil White oil.

Cocoa butter paraffin.

Substitution of powders

Powdered varieties of crude drugs may be adulterated with the below foreign & fictions materials. Sometimes foreign matter is added to crude drugs.

Eg: Capsicum Red sandalwood.

Black pepper Seeds of papaya.

Nuxvomica powder Olive stone powder.

Ginger powder Exhausted ginger.

1.5. Disadvantages of adulteration

- Adulteration causes denaturation & degradation of product.
- Adulteration may lead to deterioration of product.
- Adulterants may completely destroy the active constituents.
- May cause artificial scarcity of drug.
- That leads to damage of dosage form.
- Adulteration leads to altering of drug nature.
- The adulterants may cause damage to patient.
- Adulterants may cause death of patient.
- They may cause un-wanted side effects in patients.
- They lead to increase price of product.
- They cause to increase formulation price of dosage form.
- Adulteration leads to damage of containers also.

1.6. Commonly Used Substitution and Adulteration in Siddha Drug

Table 1. Commonly use Substitution and Adulteration in Siddha drug

S.No.	Original Drug	Adulteration or Substitution Drug	Part used
01	அதிமதுரம்	வெண்குன்றி	Root
02	கருவேலம் பிசின்	முருங்கைப்பிசின்	Resin
03	சிறுநன்னாரி	மலை நன்னாரி	Root
04	சிறுநரத்தை	நாட்டரத்தை	Rhizome
05	நிலாவாகை	ஊசித்தகரை	Leaves

06	சீரகம்	சோம்பு	Dry Fruit
07	மிளகு	பப்பாளி விதை	Seeds
08	குங்குமப் பூ	சீமை சாமந்தி	Flower
09	கற்பாசி	மரப்பாசி	Whole plant
10	<i>Myristica fragrans</i>	Bass wood	Fruit
11	Original ergot	Artificial ergot	
12	Tirunelveli senna	Cassia obovate; Arabian senna; Cassia auriculata	Leaves
13	<i>Zingiber officinale</i> (Jamaica Ginger)	Kerala Ginger; Africa Ginger; Japan Ginger	Rhizome
14	<i>Aconitum heterophyllum</i>	<i>Cryptocryne spiralis</i>	Root
15	<i>Piper cubeba</i>	<i>Piper elusi</i>	Fruit
16	<i>Piper nigrum</i>	<i>Carica papaya</i> ; <i>Lantana indica</i>	Fruit and Seeds
17	<i>Swertia chirata</i>	Dried gel of Aloe vera	Root
18	<i>Crocus sativus</i>	Artificial colouring papers	Flower
19	<i>Glycyrrhiza glabra</i>	<i>Abrus precatorius</i>	Root
20	<i>Atropa belladonna</i>	<i>Ailautaus excelsa</i>	Leaves
21	<i>Syzygium aromaticum</i>	<i>Cinnamomum wightii</i>	Flower
22	<i>Mucuna pruricus</i>	Kaatu poonaikaali seeds	Seeds
23	<i>Ferula asafoetida</i>	<i>Pterocarpus marsupium</i>	Resin
24	<i>Olea europaea</i>	Peach oil	Oil
25	<i>Catharanthus roseus</i>	<i>Solanum melougeua</i>	Root
26	<i>Strychnus nux vomica</i>	Guaicum	Seed powder
27	<i>Capsicum</i>	Brick	Powder
28	Musk	Dry blood liver, wheat, barley	Bile
29	Korosani	Bile of buffalo, fish, goat, pea cock	Bile
30	Honey	Sugar syrup	
31	White Palakarai	Yellow palakarai	

32	Cow milk	Water, starch, soap, ammonium sulphate, formaline	
33	Ghee	Vegetable oil, animal fat, potato mesh, coconut oil	
34	Coffee powder	Chikkary powder	Seed
35	Bees wax	Paraffin wax; Japan wax	
36	Cinnomomum zylanicum	Cassia bark	Bark
37	Asafoetida	Limestone	Resin
38	Turmeric powder	Mentanil Yellow	Rhizome
39	Opium	Lead shot	Latex
40	Cardamom	rodent faecal matter	Seed
41	Mustard	Argemone	Seed
42	coconut oil	White oil	Oil

2. Discussions

Commonly adulteration substances are very cheaply, much of availability in the drug industry. As a medical practitioner especially in the herbal practitioner must to know the Scientific name, Vernacular name, Commercial name and colloquial name of the original drug. Adulteration may be evaluated (or) measured by following methods. There are Morphological or Organoleptic tests, Microscopic Evaluation, Chemical Evaluation, Physical Evaluation, Biological Evaluation and Analytical methods.

Organoleptic evaluation or morphological evaluation means evaluation of drug by the organs of sense (skin, eye, tongue, nose and ear) or macroscopic evaluation and it includes evaluation of drugs by colour, odour, taste, size, shape and special feature, like touch, texture etc. it is the technique of qualitative evaluation based on the study of morphological and sensory profile of whole drugs.

Colour means external colour which varies from white to brownish black are important diagnostic characters. The general appearance (external marking) of the weight of a crude drug often indicates whether it is likely to comply with prescribed standard like furrows(alternate depression or valleys), wrinkles (fine delicate furrows), annulations (transverse rings), fissures (splits), nodules (rounded outgrowth), scars (spot left after fall of leaves, stems or roots). Taste is specific type of sensation felt by epithelial layer of tongue. It may be acidic (sour), saline (salt like), saccharic (sweetish), bitter or tasteless (possessing no taste).

Microscopic evaluation is involves detailed examination of the drug and it can be used to identify the organized drugs by their known histological characters.

It is mostly used for qualitative evaluation of organized crude drugs in entire and powder forms (Chooranam, Pashpam, Chenthooram) with help of microscope. Using microscope detecting various cellular tissues, trichomes,

stomata, starch granules, calcium oxalate crystals and aleurone grains are some of important parameters which play important role in identification of certain crude drug. Crude drug can also be identified microscopically by cutting the thin TS (transverse section), LS (Longitudinal section) especially in case of wood and by staining them with proper staining reagents e.g. starch and hemicelluloses is identified by blue color with iodine solution, all lignified tissue give pink stain with phloroglucinol, and HCl, etc.

Mucilage is stained pink with ruthenium red can be used to distinguish cellular structure. Microscopic evaluation also includes study of constituents in the powdered drug by the use of chemical reagents. Quantitative aspects of microscopy includes study of stomatal number and index, palisade ratio, vein-islet number, size of starch grains, length of fibers etc which play important role in the identification of drug. Chemical evaluation for most of drugs have definite chemical constituents to which their biological or pharmacological activity is attributed. Qualitative chemical test are used to identify certain drug or to test their purity. The isolation, purification, identification of active constituents is based on chemical methods of evaluation. Qualitative chemical test such as acid value, saponification value etc.

Preliminary phytochemical screening is a part of chemical evaluation. These qualitative chemical tests are useful in identification of chemical constituents and detection of adulteration. Physical evaluations are moisture content, specific gravity, optical rotation, refractive, melting point, viscosity and solubility in different solvents.

Pharmacological activities are Biological evaluation due to specific type of constituents present in the plant extract. (Eg: Antibiotic activity, Antifertility activity, Hypoglycemic activity, Neuropharmacological activity etc.).

HPLC is a popular method for the analysis of herbal medicines because it is easy to learn and use and is not limited by the volatility or stability of the sample compound.

3. Conclusions

This overview provides useful documented evidence for the Adulteration and Substitution which are used in Siddha Medical System as well as Indigenous Medicine to prepare the standard drug in Alternative Medical System. However, there is a need for further extensive scientific studies to be carried out to justify its clinical potential in Adulteration and Substitution.

As a medical practitioner especially in the herbal practitioner must to know the evaluated (or) measured methods in each and every drug which are using for the preparation of Medicine. Through this knowledge, may provide the standard healthcare service for Society.

Declarations

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Competing Interests Statement

Authors have declared no competing interests.

Consent for Publication

The authors declare that they consented to the publication of this study.

Ethical statement and Conflict of interest

The work presented here does not involve any experiment with human or animals.

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