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Concept of standard raw drug substitution in Traditional Siddha Medicine - A Review

Review Article

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Abstract

Classical Siddha medicine recommends the usage of functionally parallel substitute raw drugs in the scarcity of the original material. The concept of standard raw drug substitution is designated by the Tamil term *Matru sarakku*, which emphasizes selecting alternatives either in herbal or non-herbal sources based on certain attributes. Functionally similar materials are suggested for balancing the deficit based on such parameters. Literature sources from Siddha medicine and other allied subjects were explored and documented for the inclusive understanding of the concept of ideal substitution. Few of the standard substitutes mentioned in the classical Siddha literature were evaluated in a scientific account for its justification. An outlook on different specimens as described in the ancient texts of Tamil medicine indicates the usage of substitutes from numerous plants, animals, and other metallo-mineral ingredients. The rationale of selecting alternatives primarily depends on the equivalent following traditional attributes like organoleptic entities, potency, division, general properties, specific actions, and medicinal uses of the material shared between the raw drugs. This must undergo a systematic evaluation by pharmacognostic and phytochemical studies to justify current practices of substitution. A systematic document in these lines will give a proper guideline for the effective employment of substitute drugs in the current scenario of dwindling official botanical sources for many Traditional Siddha formulations.

Key Words: *Agathiyar Vaidhya Chinthamani, Raw drug Substitutes, Siddha literature, Traditional Siddha Medicine, Traditional attributes.*

Introduction

The global renaissance in indigenous medicines and therapies has escalated the herbal commodity market. (1) The effectiveness of traditional medicine is contingent upon the proper use of sustained availability of genuine raw materials. Approximately 80% of the population from developing nations depend on herbal raw drugs or their products for their primary health care needs. Many of the prescribed medicines or consumer health care products intended for wellness that is marketed worldwide are derivatives from plant species chiefly of wild origin. (2) According to Hamilton, the Indian subcontinent is a rich source of flora in which nearly 44% of it is used for medicinal purposes. (2) AYUSH system of medicines as a whole uses nearly 2400 herbal species, apart from around 6000 species used in other Indian folklore traditions. (3,4) A total of 9600 registered pharma industries, other unregistered firms, recognized practitioners and native healers all depend on the present limited resources to meet the needs of the public health sector. (3) Only less than 10% of the cultivated source is available in the market and fact, most of the ingredients either fresh or dry are procured directly from its natural habitat. This resulted in massive depletion of resources. The soaring demand versus inadequacy is a long pending issue confronted by the current herbal trade; the scarcity brings about irrational use of adulterants and substitutes in place of authentic materials.

As one of the popular medical systems of south Indian peninsular regions, Siddha medicine uses a substantial part of raw drugs from the herbal vegetation. (9) Herbal products are the key entity to any sort of remedial measures affirmed by the practitioners of

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Traditional Siddha Medicine (TSM). The vast materia medica embraces descriptions of thousands of medicinal plants and their by-products to be used in its exquisite formulary arsenal.(10,11)

The notion of using genuine replacements to the unobtainable herbal resources are documented in the classical Siddha texts. The treatise about raw drug substitution by sage *Agathiyar*, in his Tamil medical text *Agathiyar Vaidhya Chinthamani* (AVC) throws light on the numerous prospects of using tributary herbal and non-herbal resources in the absence of original materials. (12) The terminology '*Matru sarakku'* (MS) in Siddha medicine is defined as the usage of reliable alternatives in the absence or inaccessibility of the raw drug in demand.(12,13)

As numerous substitutes mentioned in the classical books, an attempt was made to document a few of the established substitute pairs and their rational part in the light of scientific understandings done in this review paper.

Methodology

Literature sources from Siddha medicine and other allied subjects were explored and documented for an inclusive understanding of the concept of MS. The detailed list of substitutes used in current practices is interpreted from the published journals, books, and periodicals. Few of the standard substitutes mentioned in the classical Siddha works were evaluated from a scientific viewpoint for their justified usage.

Observation and Discussion

Unethical substitution and adulteration are the major trends in the market. The deceitful practice that has been done intentionally for commercial gain comes under unethical substitution. In the south Indian market alone, there is 70 to 100% reported adulteration in raw drugs like *Nuna* (*Morinda tinctoria* Roxb.), *Maramanjal* (*Coscinium fenestratum* (Goetgh.) Colebr) and *Vaividangam* (*Embelia ribes* Burm.f.).(3) The fraudulent practice of unethical substitution and adulteration causes serious health complications starting from liver and kidney failure or even up to multiple organ failure. (14) There are so many motives that result in substantial adulteration that occur primarily due to scarcity of raw drug resources or depletion of the source, cost of the drug or overheads in procuring, resemblance in morphological and organoleptic characters between substitute and original drugs, seasonal unavailability, geographical or regional substitution etc.(3,14) List of common substitutes/ adulterants and standard substitutes available in the raw drug market is tabulated (Table 1). From the list, it can be inferred that the practice of adulteration is more common than the approved substitutes. (15-31)

Table 1- List of raw drugs which are employed as substitutes in the market

S.No	Tamil Name of original Raw drug	Botanical name	Part used	Substituted with
1	*Akayathamarai*	*Pistia stratiotes* Linn.	Whole plant	Whole plant of *Eichhornia crassipes* (Mart.) Solms
2	*Asoku*	*Saraca asoca* (Roxb.) de Wilde.	Bark	Bark of *Shorea robusta* Gaertn.f.
3	*Athimathuram*	*Glycyrrhiza glabra* Linn.	Root	Root of *Abrus precatorius* Linn.
4	*Chiruthekku*	*Clerodendron serratum* Linn.	Bark	The bark of *Premna herbacea* Roxb.
5	*Etti*	*Strychnos nux vomica Linn*.	Seed	Seeds of *Strychnos potatorum*Willd.
6	*Iruvi*	*Dryopteris filix-mass* Linn.	Fern (Rhizome)	Rhizome of *Osmunda claytoniana* Linn.
7	*Pushkaramoolam*	*Inula racemosa* Hook.f.	*Root*	Root of *Saussurea costus (Falc.) Lipsch.* *
8	*Kontrai*	*Cassia fistula* Linn.	Bark	The bark of *Acacia leucophloea* Willd.
9	*Kookaineeru*	*Maranta arundinacea* Linn.	Rhizome starch	Rhizome starch of *Tacca pinnatifeda* Forst.
10	*Kudasapalai*	*Holarrhena antidysenterica* Linn.	Bark	The bark of *Wrightia tinctoria* R.Br.
11	*Manjitti*	*Rubia tinctorium* Linn.	Root	The root of *Rubia cordifolia* L. *
12	*Mookirattai*	*Boerhavia diffusa* Linn.	Whole plant	Whole plant of *Trianthema portulacastrum* Linn.
13	*Nabi*	*Aconitum napellus* Linn.	Root	The root of *Aconitum chasmanthum* Stapf ex Holmes
14	*Nervalam*	*Croton tiglium* Linn.	Seeds	Seeds of *Baliospermum montanum*Willd.
15	*Nilavagai*	*Cassia senna* Linn.	Leaves and pods	Leaves and pods of *Pluchea lanceolata*
16	*Peetharohini*	*Coptis teeta* Wall.	Root	The root of *Thalictrum foliosum* DC.
17	*Poonaikkali*	*Mucuna pruriens* Linn.	Seed	Seeds of *Mucuna utilis* Wall.
18	*Sathappu/Aruvatha*	*Ruta graveolens* Linn.	Leaves Whole plant	Whole plant of *Ruta chalepensis* Linn. *
19	*Sirunagapoo*	*Mesua ferrea* Linn.	Flower buds	Flower buds of *Cinnamomum wightii**
20	*Sitramutti*	*Sida rhombifolia* Linn.	Root	Root of *Pavonia odorata* Willd.
21	*Vaividangam*	*Embelia ribes* Linn.	Fruit	Fruit of *Embelia tsjeriamcottam DC**
22	*Vettiver*	*Vetiveria zizanioides* Linn.	Root	Root of *Coleus vettiveroides* Jacob *

*** Substitute widely used in the market**

Unavailability of raw drugs due to the mass extinction of genuine species is the major concern of AYUSH pharma industries. As per the 2015 IUCN, red list of threatened plants in India, a total of 18 plant species have become extinct, 41 under extinct/ endangered category, 52 plant species under endangered class, 102 under vulnerable status, and 251 under rare status. The updated list of IUCN (2015) includes 44 Indian plants. This includes many of the widely used medicinal plants in the AYUSH system of medicines. (2,32) Some of the commonly used Siddha herbs like *Athividayam* (*Aconitum heterophyllum* Wall. ex Royle) and *Sadamanjil* (*Nardostachys jatamansi* (D.Don) DC.) are already on the critically endangered list. (14)

Many unethical substitutions and adulteration practices are based on the morphological similarity of raw drugs with that of the original drugs observed. The dried juice of *Knema angustifolia* Roxb resembles that of *Pterocarpus marsupium.* Roxb and hence it is substituted. The style and florets of *Kumkumapoo* (*Crocus sativus* Linn.) are adulterated with the dried ray florets of french marigold (*Tagetes patula* Linn.) because of their striking similarity. (15,16)

The similarity in organoleptic characters like taste and odour is another vast area of substitution. E.g. the camphor extracted from leaves of camphor basil (*Karpoora Tulasi – Ocimum kilimandscharium* Guerke) and *Ocimum cannum* Sims), possess the characteristic odour and taste of natural *karpooram* (camphor) obtained from *Cinnamomum camphora* Linn and therefore substituted. The plant of *Mimulus moschatus* Dougl has an aroma similar to the original expensive *Kasthuri* (Musk) and hence adulterated in many places. The essential oil extracted from the leaves of *Limnophila rugosa* Roth tastes and smells similar to the essential oil from *Ocimum basilicum* Linn and therefore adulterated. The seeds of *Abelmoschus moschatus* Medic resemble musk in flavour, therefore used for flavouring oils in place of *Kasthuri* (Musk). (23)

Illogical substitution is the practice that is unintentionally done due to the lack of awareness or the unfamiliar identity of the prescribed plant species or due to misperception of ingredients in the master formulations. In the majority, most of the substitutes are in practice without the proper authentication or verification of their efficacy or neither aware of the ill effects of substituting it. A single raw drug or herbal material is often used as the substitute for the original material in demand. For eg. *Kadukkai pu* (The foliar gall of *Terminalia chebula* Retz.) is misconstrued with completely different *Karkadakacinki* (The gall of *Pistacia intregerrima* Stew. Ex Brandis) and used as the substitute. The incongruity of traditional synonyms of several raw drugs is another factor for illogical substitution. For eg. *Kanduparanki* (*Pygmaeopremna herbacea* Roxb.) is a synonym of *Cirutheku* (*Clerodendron serratum* Linn.), both are entirely different plants but mistaken and used due to the misperception in the vernacular name. (14,33)

The logical or standard substitutes (*Matru sarakku*) are the genuine practice of substitution, mentioned in Siddha medicine, which is justifiable accordingly with the current situation following the norms of traditional practice and established literature. It is justified to use alternatives in the absence of one or more ingredients either for medicinal preparation or for other therapeutic practices. Nevertheless, it is unethical to use the substitute for the prime drug of the formulation. As in *Ammukkura Choornam*, *Ammukkura* (*Withania somnifera* Dunal.), the prime drug should not be replaced with any substitute.[34] One of the notable recommendations on standard substitutes is from the classical Tamil medical text "*Agasthyar Vaidhya Chinthamani*".(12) The book details 39 substitute pairs including non-herbal sources. According to various literature works in Siddha medicine, the substitute should have parallel properties in terms of its class (*Vargam*), source of the essential part (*Saram*), organoleptic characters like *Suvai* (taste characteristics) and odour (*Manam*). In addition, the identical potency (*Thanmai*) of the substituted raw drug, its general properties (*Pothu gunam*), special attributes or actions (*Ceykai*) and therapeutic benefits (*Maruthuva gunam*) should match with that of the original raw drug. (12) Either of the above criteria has to support with textual references or traditional expert practices for establishing its genuineness. The important substitute pairs are detailed in Table 2.

Table 2- Important Standard raw material substitutes mentioned in the classical text *Agasthyar Vaidhya Chinthamani*

S.No	Original drug	Botanical Name	Standard substitute (*Matru sarakku*)	Botanical Name
1	*Aadutheenda palai*	*Aristolochia bracteolata Lam.*	*Chenthotti*	*Pavonia odorata Willd.*
2	*Arathai*	*Alpinia officinarum* Hance.	*Chukku*	*Dry Zingiber officinale Rosc.*
3	*Athimathuram*	*Glycyrrhiza glabra* Linn.	*Pereechu*	*Phoenix dactylifera Linn.*
4	*Athimathuram*	*Glycyrrhiza glabra* Linn.	*Drakshai*	*Vitis vinefera* Linn.
5	*Attavarkam* *		*Kadukkai*	*Terminalia chebula* Retz.
6	*Chukku*	Dry *Zingiber officinale* Rosc.	*Inji*	Fresh *Zingiber officinale* Rosc.
7	*Iluppai*	*Madhuca longifolia* Koen.	*Sitramutti/ Peramutti*	*Sida rhombifolia Linn.* or *Pavonia odorata* Willd.
8	*Kandangathiri*	*Solanum xanthocarpum* Schrad. &Wendl	*Thalisapathiri*	*Abies webbiana* Linn.
9	*Kandangathiri*	*Solanum xanthocarpum* Schrad.&Wendl	*Mulli*	*Solanum anguivi* Lam
10	*Karpooram*	*Cinnamomum camphora* Linn.	*Siruthekku*	*Clerodendron serratum* Linn.
11	*Kavattai*	*Cymbopogon nardus (L.) Rendle*	*Seeragam*	*Cuminum cyminum* Linn.

12	*Kodiveli*	*Plumbago zeylanica* Linn.	*Etti*	*Strychnos vomica* Linn.
13	*Kudasapalai*	*Holarrhena antidysenterica* Linn.	*Lavangapattai*	*Cinnamomum verum* J.S.Presl
14	*Kumkumapoo*	*Crocus sativus* Linn.	*Thamaraikesaram*	Stamens of *Nelumbo nucifera* Gaertn.
15	*MulKiluvai*	*Commiphora mukul (Hook. ex Stocks) Engl.*	*Veppam pisin*	Gum of *Azadirachta indica* A.Juss.
16	*Nel*	*Common Oryza sativa Linn.*	*Chamba nel*	*Chamba* variety of *Oryza sativa Linn.*
17	*Nervalam*	*Croton tiglium Linn.*	*Sivathai*	*Operculina turpethum Linn.*
18	*Pachaipayaru*	*Vigna radiata (L.) R.Wilczek*	*Pani payaru*	*Phaseolus trilobatus (L.) Schreb.*
19	*Poolan kizhangu*	*Phyllanthus reticulatus Poir.*	*Thamarai kizhangu*	Rhizome of *Nelumbo nucifera Gaertn.*
20	*Purasu*	*Butea monosperma (Lam.) Taub.*	*Peyathi*	*Ficus hispida L.f.*
21	*Saattaranai*	*Trianthema decandra Linn.*	*Mookkirattai*	*Boerhavia diffusa Linn.*
22	*Sadamanjil*	*Nardostacys jatamansi DC.*	*Muthakasu*	*Cyperus rotundus L.*
23	*Seeragam*	*Cuminum cyminum Linn.*	*Karunseeragam*	*Nigella sativa Linn.*
24	*Sitramutti*	*Sida rhombifolia Linn.*	*Peramutti*	*Pavonia odorata Willd.*
25	*Thippili*	*Piper longum L.*	*Milagu*	*Piper nigrum Linn.*
26	*Thotti*	*Pavonia odorata Willd.*	*Thura*	*Fumaria officinalis L.*
27	*Vila*	*Limonia acidissima Linn.*	*Vilvam*	*Aegle marmelos Linn.*
28	*Yavai*	*Hordeum vulgare L.*	*Kadalai payaru*	*Cicer arietinum Linn.*

*The group of 8 raw materials belonging to a common *varkam* (category): *Seeragam* (*Cuminum cyminum Linn.*), *Karinjeeragam (Nigella sativa Linn.*), *Chukku* (*Zingiber officinale Rosc.*), *Milagu* (*Piper nigrum Linn.*), *Thippili* (*Piper longum L.*), *Induppu* (*Halite*) and *Perunkayam* (*Ferrula asafoetida* Linn)

Categorization of substitutes

The substitution defined in the classical Siddha literature are broadly classified as follows:

a. *Substitution with different parts of the same herb*

It is a very common exercise of reasonable substitution in which, if the specific part of a plant designated is absent an alternative part added up to meet the requirement of the formulation. The roots of so many herbs are the primary source for most of the herbal formulation in Siddha medicine as in the case of its absence or reduced quantity of supply; the aerial parts or stem is added as in the case of *perum panchamoolam* (5 primary root parts used in Siddha medicine).[10] Sometimes *samoolam* (whole plant part) is used to meet the needed measure. This also includes the type of substitution by bulk addition like the usage of the whole root of *kodiveli* (*Plumbago zeylanica* L.) instead of root bark and in *pungu* (*Pongamia pinnata* (L.) Pierre) instead of its root bark, stem bark is used in the formulations. In most cases, the whole fruit of *Elam* (*Elettaria cardamomum* (L.) Maton) is used, even if the formulation insists on the usage of its seed only. (11)

b. *Substitution within the same species*

The plants belonging to the same species of Nyctaginacea family-like *Charanai* (*Trianthema portulacastrum* Linn.), *vellai charanai* (White variety of *Trianthema decandra* Linn.), (small variety *Trianthema triquetra* Rottler & Willd.) are used as substitutes for each other based on their common therapeutic effects. Likewise, the substitution of *perarathai* (*Alpinia galanga* (L.) Willd.) with *chittarathai* (*Alpinia officinarum* Hance) has similar morphology and pharmacology. (10) *Alpinia calcarata* (Haw.) Roscoe commonly substituted for *Alpinia officinarum* Hance in Tamil Nadu due to its availability.

c. *Substitution with different species of the same family*

As an example, *Arathai* (*Alpinia officinarum* Hance) substituted with *Chukku* (*Zingiber officinale* Roscoe) which are morphologically dissimilar. The identical source material is used in both, and there is significant similarity in traditional attributes like taste, potency, and division (Table 3). Both share almost the same general property, actions, and medicinal uses. Many scientific studies view its common pharmacological activities also. (35- 38)

Table 3 - Substitution with different species of the same botanical family

Attributes	Original raw drug	Standard substitute
Name	*Arathai*	*Chukku*
Scientific name	*Alpinia officinarum* Linn.	*Zingiber officinale* Rosc
Family	Zingiberaceae	Zingiberaceae
Source (Saram)	Rhizome	Rhizome
Suvai (Taste)	*Karppu* (Pungent)	*Karppu* (Pungent)
Thanmai (Potency)	*Veppam* (Hot)	*Veppam* (Hot)
Pirivu (Division)	*Karppu* (Pungent)	*Karppu* (Pungent)

Pothugunam (General property)	*Iraippu* (Bronchial asthma) *Irumal* (Cough) Iyyam (Phlegmatic disorders) *Karappan* (Eczema) *Kayam* (Tuberculosis) *Marbunoi* (Cardiac diseases) *Moolam* (Hemorrhoids) *Sobai* (Dropsy) *Vanthi* (Emesis) *Sanni* (Delirium) *Suram* (Fever) *Valikutram* (Vatha diseases) *Vayu* (Gaseous disturbances)	*Iraippu* (Bronchial asthma) *Irumal* (Cough) *Iyyasuram* (Fever due to phlegmatic origin) *Kathukuthal* (Pricking pain inside the ears) *Kazhichal* (Diarrhoel diseases) *Mughanoi* (Diseases of the face) *Keezhvainoi* (Diseases of the anorectal region) *Neeretram* (Sinusitis) *Puliyeppam* (Sour belching) *Seriyamai* (Dyspepsia) *Thalainoi* (Diseases of the head) *Vayitrukuthal* (Pricking sensation of the abdomen) *Vayu gunmam* (Painful Gastrointestinal affections) *Vayitruppisam* (Bloating sensation of the abdomen)
Ceykai (Pharmacological action)	*Akattuvayvaktri* (Carminative) *Pasitheethoondi* (Stomachic) *Veppamundakki* (Stimulant) *Veppakatri* (Febrifuge) *Kozhaiakatri* (Expectorant)	*Akattuvayvaktri* (Carminative) *Pasitheethoondi* (Stomachic) *Veppamundakki* (Stimulant)
Evidence-based Pharmacological Actions	Analgesic Anti-cancer Antiemetic Anti-inflammatory Antilipidemic Anti-microbial Anti-oxidant Antiviral Hepatoprotective Platelet Activating Factor (PAF) inhibitory action Vasorelaxant	Analgesic Antitumorogenic Antiemetic Anti-inflammatory Antilipidemic Antimicrobial Antioxidant Antiviral Hepatoprotective Antithrombotic Antiplatelet activity Antihypertensive
Therapeutic uses	Respiratory ailments like whooping cough, bronchial catarrh and asthma. Rheumatism Throat affections Fever	Dyspnoea Cough Arthritis Ear diseases Dyspepsia

d. *Substitution with herbs belonging to the different families*:

For eg. *Cinnamomum verum* J.Presl is substituted for *Holarrhena antidysenterica* (Roth) Wall. ex A.DC. which belong to an entirely different family. Both share similar traditional attributes. (12)

e. *Substitutes to Animal products*:

Indrakopam (*Mutilla occidentalis* - insect) is used by the traditional Siddha healers for numerous ailments. For substituting the material, *Valuzhuvai* (*Celastrus paniculatus* Willd.) is selected which has the following attributes identical to the animal material (Table 4). In this case, there are no relative morphological, organoleptic resemblances of both of the raw drugs belonging to two different sources. The identical potency, general property, special action, and medicinal uses may be the deciding factor for the substitution. It has been advocated to use this alternative in conditions where the original drug does not suit the health condition of the patient due to its potency. The substitution aimed to minimize the predictable ill effects without changing the general therapeutic outcome needed. (38)

White goats milk is mentioned as an important nutritional regimen in Siddha medicine for respiratory ailments. In the time of its unavailability, cow's milk boiled with dry ginger and root of *Tragia involucrata* L. is considered equivalent to the same regimen is substituted. *Palakarai* (Cowrie shell – *Cypraea moneta*) can be substituted with *muthuchippi* (Oyster shell - *Pinctada vulgaris*) having almost the same property.(12,38) Mothers milk can be substituted with cow's milk. (11).

Table 4- Substitutes to Animal products

Attributes	Original raw drug	Standard substitute
Name	*Indrakopam*	*Valuzhuvai*
Scientific name	*Mutilla occidentalis*	*Celastrus paniculatus*.Willd
***Saram* (Source)**	Insect- Animal origin	Seed- Plant origin
***Thanmai* (Potency)**	*Veppam* (Hot Potency)	*Veppam* (Hot Potency)
***Panchabootha-adipadai* (Five element class)**	Fire	Fire
***Pothugunam* (General property)**	*Sukkila nattam* (Spermatorrhoea) Rejuvenator Cures phlegmatic disorders	Cures phlegmatic disorders Hemiparesis (*Parisa Vayu*)

Ceykai **(Special Action)**	Nervine tonic Tonic and spermatogenic Aphrodisiac Strengthens muscles	Nervine tonic Tonic and spermatogenic Aphrodisiac Stimulant
Maruthva gunam **(Therapeutic uses)**	Hemiparesis (*Parisa Vayu*), Nervine diseases Neuralgia Whooping cough	Hemiparesis (*Parisa Vayu*) Neuralgia

***f. Mineral and metal substitutes*:**

The crude metal gold is included as one of the main components in so many effective formulations in Siddha medicine meant for respiratory ailments and male infertility. (38) By considering the cost factor, it is advised to substitute with metal silver, which is equally effective and economical than the original material (Table 5). (12)

Table 5- Substitution of Metallic crude drugs

Attributes	Original raw drug	Standard substitute
Name	*Pon* (Gold)	*Velli* (Silver)
Scientific name	Aurum	Argentum
Varkam **(Category)**	*Inippu* (Sweet)	*Inippu* (Sweet)
Suvai **(Taste)**	*Inippu* (Sweet)	*Inippu* (Sweet)
Thanmai **(Potency)**	*Veppam* (Hot)	*Thatpam* (Cold)
Pirivu **(Division)**	*Inippu* (Sweet)	*Inippu* (Sweet)
Pothugunam **(General property)**	*Irumal* (Cough) *Kaphanoi* (Phlegmatic diseases) *Kayam* (Tuberculosis) *Kozhai* (Phlegmatic affections) *Suram* (Fever) *Thathunattam* (Spermatorrhoea) *Thirithodam/Sanni* (Delirium) *Vizhinoi* (Eye diseases)	*Irumal* (Cough) *Kaphanoi* (Phlegmatic diseases) *Kayam* (Tuberculosis) *Kozhai* (Phlegmatic affections) *Puranasuram* (Chronic fever) *Ozhukku velai* (Leucorrhoea) *Thirithodam/Sanni* (Delirium) *Vizhinoi* (Eye diseases)
Ceykai **(Special Action)**	*Kamamperukki* (Aphrodisiac) *Udal thetri* (Tonic) *Narambu uramundakki* (Nervine tonic) *Ruthuundakki* (Emmenegogue)	*Kamamperukki* (Aphrodisiac) *Udal uramakki* (Tonic) *Isivakatri* (Antispasmodic) *Malamilakki* (Laxative) *Pasitheethoondi* (Stomachic) *Thathuveppakatri* (Sedative) *Ullazhaltri* (Demulcent) *Veppamundakki* (Stimulant)

g. *Substitution with Vaippu sarakku* (*Synthetic materials*):

Preparation of synthetic substances (*Vaippu sarakku*) from natural elements that match the therapeutic quality of the original drug is well appreciated in the alchemical part of Siddha science. Such materials are widely used in the absence of crude drugs are essential for the preparation of higher-order medicines of Siddha. Most minerals and rare metals have synthetic substitutes. Few synthetic products which are used as herbal raw drug substitutes are also mentioned. Synthetic substitutes like *Induppu* (Halite), *Turisu* (Blue vitriol), *Lingam* (Cinnabar), *Navasaram* (Sal Ammoniac), *Padikaram* (Alum), *Venkaram* (Borax), *Nagam* (Zinc metal), *Karuvangam* (Black lead), *Karpooram* (Camphor), *Pachaikarpooram* (Borneo camphor), *Sambrani* (*Boswellia serrata*) are some of the examples described in the classics of Tamil medicine. (39-41)

Criteria for selection of standard substitutes

The criteria of selecting a substitute involve the below stringent aspects. These should be well thought before deciding the ideal substitute for the original material in demand. (Table 6)

1. *Vargam* (Category)

There are six categories of raw drugs based on their principal taste. If both raw drug and its substitute fall under the same category, it is a lead for the selection. (12)

2. *Saram* (Main source or morphological identity)

This includes six divisions of an essential part of a plant material used in medicine. If the original material and its substitute fall under a similar division, it is an advantage for substitution. (12)

3. *Traditional attributes*

The typical characters of a raw material stated in the perspective of Siddha traditional concept are detailed in Table 7. (12, 38, 41)

Table 6- Standard substitute (Matru Sarakku) - Criteria of Selection		
***Vargam* (Category in terms of taste)**	***Saram* (Main source of material/ morphological identity)**	**Traditional Attributes**
(Sweet)	*Ilai Saram* (Leaf part)	(Taste Attributes)
(Bitter)	*Ver Saram* (Root part)	(Odour)
(Astringent)	*Kai/Kani Saram* (Fruit part)	(Potency)
(Pungent)	*Vithai Saram* (Seed part)	(Humoral division)
(Sour)	*Poo Saram* (Flower part)	(Elemental division)
(Salt)	*Pattai Saram* (Bark part)	(Disease classifieds)
	Kattai Saram/ vairam (Hard wood part)	(General property)
	Pisin saram (Gum and resin part)	(Specific actions)
		(Common therapeutic uses)

Table 7-Traditional attributes of a substitute	
Traditional attributes	**Description**
Suvai	Taste qualities and association
Manam	The odour of the raw drug
Thanmai	Whether the raw drug belong to hot or cold potency
Mukutra Adipadai	Raw drugs are classified based on their nature of pacifying the *kutrams* (three humors)
Panchabootha Adipadai	Based on the predominant five elements
Noi Kanam	Classification of raw drugs based on specific diseases
Pothu gunam	The similarity in general properties
Ceykai	The similarity in specific pharmacological actions
Maruthuva Gunam	The similarity in therapeutic uses.

Thus, in Siddha medicine substitutes are considered and selected based on their category of predominant taste, the essential part of the plant used with maximum therapeutic value, morphological resemblances, and traditional attributes. Identical traditional attributes are determined as the core principle of Siddha raw drug substitution. Even if the category or morphological factors differ between substitute and original drug, it is obligatory to have substantial equivalency in traditional qualities to validate it as the standard substitute.

Conclusion

Many of the raw drug substitution practices in the market are hazardous to health and further needs vigorous studies for establishing its genuineness with the original material. A thoughtful scientific approach on the rationality of the Siddha concept of *Matru sarakku* (Standard drug substitution) could lead to novel means of detecting appropriate raw drug alternatives to solve many of the issues faced by the herbal industries. Traditional attributes of a raw drug are the main deciding factor for affirming it as a standard substitute or not. The substitutes as mentioned in the classical works should be made for systematic evaluation by pharmacognostic and phytochemical studies. This will ensure its justification in the current practices for its effective implementation.

Effective phases initiated in the field of conservation and cultivation of endangered species, stringent policies to tackle adulteration and illogical substitution is the only long-term resolution to ensure the availability of original raw drugs, which is the prime base for AYUSH health care systems.

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