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Review Article

VANSHLOCHAN SUBSTITUTION AND ADULTERATION: DISCUSSIONS ON THE CONTROVERSY OVER ITS ORIGINAL SOURCE

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ABSTRACT

In India, about 80% of the rural population relies on herbal remedies for their basic medical needs. The increasing demand and trading of raw materials for herbal medicines often involve adulterants and substitutes. The reasons behind intentional adulteration are typically commercial and include degradation, admixture, sophistication, inferiority, spoiling, and other unidentified causes. Substitution is the use of comparable medications instead of the original ones. Similar *Rasa*, *Guna*, *Virya*, *Vipaka*, and most importantly *Karma* are the guiding principles for choosing alternative medicaments. The adulteration and substitution of herbal medications are currently a major issue in both the herbal business and Ayurvedic therapies. *Vanshlochan* or *Tabasheer* is one of the example, which has long been used as an anti-tussive in traditional medicine to cure a variety of illnesses. When this compound was first derived, the major constituent was silica with traces of other elements. *Vanshlochan* is prescribed as a bioavailability booster and offers a synergistic component to some well-known medications, including *Sitopaladi*, *Talisadi*, and *Dadimashtaka* in Ayurveda and other Unani formulations. To be utilized as a medication in conventional medicine, *Vanshlochan* needs stringent pharmaco-analytical approaches with evidence-based studies regarding its drug safety for human consumption. Therefore, it is essential to provide trustworthy procedures for the accurate identification, standardization, and quality control of *Vanshlochan*, *Tabasheer*, or *Tugaksheeri*.

INTRODUCTION

'Ayurveda', which is a branch of biological as well as a spiritual science, is thought to have existed in the Indian Subcontinent for the last 5000 years. This well-known medicinal system is now being accepted and practiced around the world.[1] In Ayurveda, medicinal plants are the main source of medications. India is one of the top 12 nations in the world harboring a mega phyto-diversity. More than one-fourth (approx. 8000) of the 30,000 known medicinal plant species in the world are found in India, making it a valuable supply of medicinal raw materials for both traditional medical systems and the pharmaceutical industry[2]. Globally, medicinal plants are important suppliers of novel medications and about 90% of more than 1300 medicinal plants that are utilized in Europe come from wild sources. In addition, approximately 25% of medications prescribed in affluent nations come from local plant species, while up to 80% of individuals in underdeveloped nations completely rely on herbal medicines for their basic healthcare necessities[3]. Nearly 300 species of Indian medicinal plants have been identified as being in danger of extinction in their natural habitat due to rising demand for medicinal herbs as well as habitat degradation and fragmentation. Due to the rising demand and decrease in supply of natural resources, the lack of availability of pure crude pharmaceuticals, replacement and adulteration procedures are becoming more and more prevalent. The lack of medicinally useful plants, a lack of comprehension and parallel formed knowledge

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systems such as the capacity to name plants by recognizing species with partially or completely comparable traits, the intrinsic characteristics of accents and dialects, non-medical literature describing the flora, *etc*. are some of the confounding factors influencing adulteration and substitution in medicinal plants[4].

Ever since the aboriginal times, human civilization has shared a profound relationship with Mother Nature. People across the world have been using different plants (herbs, shrubs, trees, climbers, etc.) in daily routine as per their needs and accessibility which has led to tagging common names for plants by them just as similar to other objects for their convenience[5]. Thus, plant names gained popularity based on local customs, traditions, or effects, and are now known by their common or vernacular names. However, this led to a single plant being known by its various local names due to its availability in scattered geographical locations[6,7].

An example of such substance of medicinal plant origin that is offered in the Indian market without a reliable official verification procedure is '*Vanshlochan*' or '*Tabasheer*'. Every year, the Indian herbal business uses an estimated 2000 MT of *Vanshlochan* to make Ayurvedic, Siddha, and Unani formulations[8]. True "*Vanshlochan*" is a transparent white material, some of which may have a bluish tint and are said to be of higher quality, mostly made of silica and water with trace quantities of lime and potash[9]. But, the market offers a wide variety of formulations that are not based on ancient literature but rather on the physician's expertise or the logical combination of ingredients. Ironically, though, none of the preparations provide adequate outcomes. The primary issue is the lack of exact conventional medications on the market. Some medications are hard to come by, however the market does provide some substitutes. Substitution can take place in the form of replacing expensive ingredients to rather abundant or inexpensive ones. Also, some vital expensive ingredients are not included in the formulation, although their names are listed on the labels. *Sitopaladi* churna is one of the most popular formulations that lack suitable results. In this preparation, *Vanshlochan* is included. However, chemically processed *Vanshlochan* that lacks the aforementioned qualities is being sold in markets in place of the authentic *Vanshlochan* that is gathered from bamboo. *Vanshlochan* which has been chemically synthesized is added to the mixture, but it has no effect[10].

Vanshlochan has been scarcely available on the market. It has been shown to be marketed under the name of the genuine medicament, but is created by burning bamboo stems instead of the traditional process of production. It also has bamboo stem ash in majority in addition to small quantities of real *Vanshlochan*. Only about 0.3 to 0.50% silica by weight is present in this generic form of *Vanshlochan*[11]. The highly important silicon-oxide (SiO_2) secretions or exudation of components with extreme medicinal relevance from the delicate stem knots of *Bambusa arundinacea* (Retz.) Willd. are used to produce herbal crystals of high purity, which tend to restore elasticity or suppleness of tissues and is utilized for medicinal preparation. It is commonly referred to as "*Banslochan*" or "*Vanshlochan*" or "*Tabasheer*" or ''*Tugaksheeri''* or "Bamboo Manna" or "Bamboo Silica" and many other names. This extracted material has aphrodisiac, antispasmodic, febrifuge, astringent, and stimulant effects when used for medicinal purposes. It is primarily composed of silicic acid (~97%) with remaining 3% of organic matter[12].

Geographical distribution of *Bambusa arundinacea* (Retz.) Willd. states that this plant is a native of tropical Asia, but also cultivated throughout the tropics around the world, mainly found in Myanmar and Sri lanka. In India, it is found throughout the plains and low hill, forests of Eastern India up to 2100 m and in West and Southern region up to an elevation of 1500 m.

Manufacturing of *Vanshlochan*

The traditional method for making medications from *Vanshlochan* is particularly unusual because it entails applying sea salt to the internodes of a *Bambusa* culm that has been covered in natural red clay. The mixture is then roasted at a temperature ranging from 1000 to 14,000°C utilizing pines as fuel for at least two to three separate roasting sessions. The optimum results, however, are obtained by roasting this stacked bamboo culm at least nine times, resulting in the production of "purple-colored salt".

Ashtanga Samgraha describes *Vanshlochan* and *Tabasheer* as two distinct remedies by virtue of their isolation sources but their therapeutic effects have been stated more or less the same[13]. It can be observed that *Vanshlochan* has been replaced with *Tabasheer* in modern times. In Ayurveda, the names "*Vanshlochan*" or "*Tabasheer*" are equivalent, however, their basionym refers to distinct species. It is a bamboo exudate, which now rarely seen on the market in purity. In Sanskrit, the rhizome of *Curcuma angustifolia* Roxb.[14], used as *Tabasheer* (also known as Tikhur and East Indian Arrowroute) which is sold in the market under the brand name *Vanshlochan* (Dravya Guna Vigyanam).

Figure 1: *Vanshlochan* images showing a bluish tint of siliceous concretions

Nature of *Vanshlochan*

Approximately 20% of the earth's atmosphere is composed of Silicon (Si). It is a critical element and is existent, usually in small concentrations, in all living creatures[15-22]. The silica-like substance found near to the joint, has the appearance of white camphor crystals and tastes sweet and slightly sticky[23,24]. Shoot contains active constituents such as oxalic acid, reducing sugar, resins, waxes, HCN, benzoic acid[25], diferuloyl arabino-xylan-hexasaccharide, diferuloyl oligosaccharide[26]. *Vanshlochan* has a high concentration of natural Bamboo silica, which contains more silicon dioxide than other plant sources.

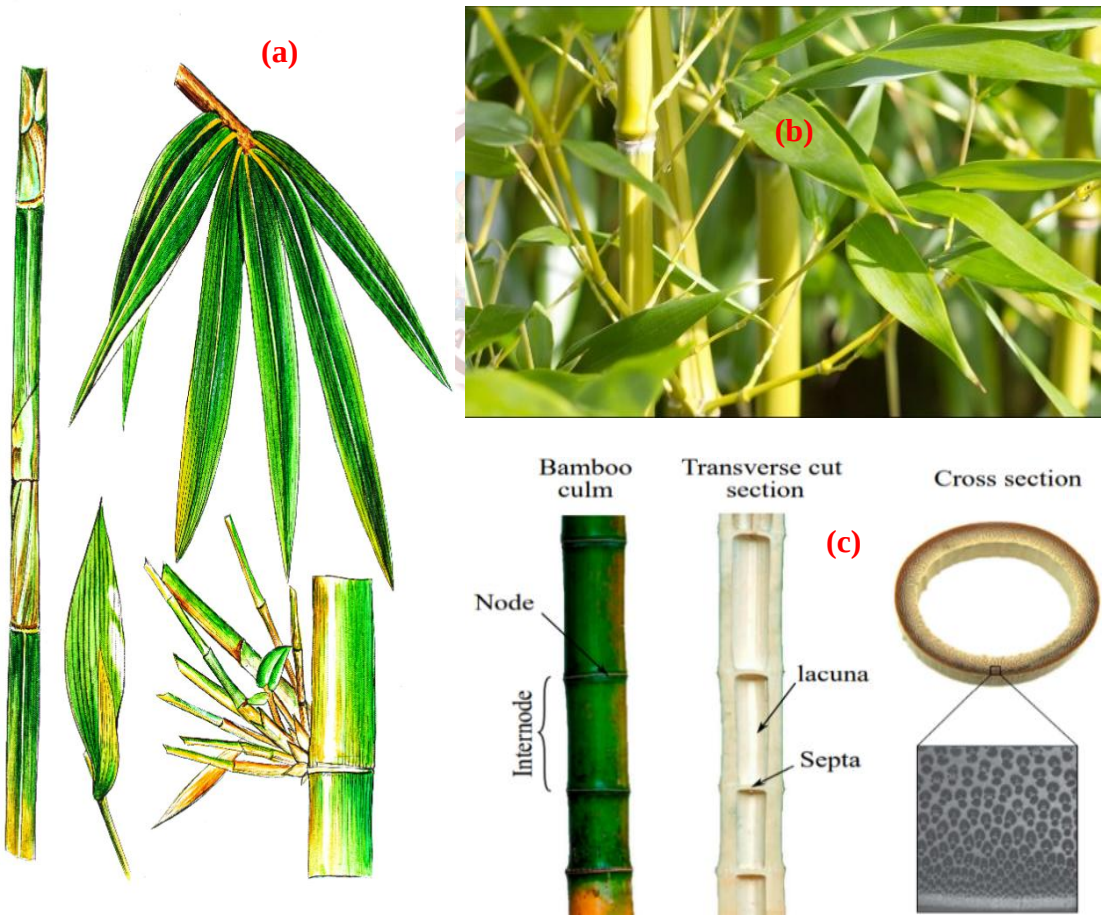

Figure 2 (a): Painting of *Bambusa arundinacea* (Retz.) Willd. (Source: Patanjali Herbal Museum) (b) Young plants of *B. arundinacea* (Retz.) Willd. (c) Culm of *B. arundinacea* (Retz.) Willd.[27]

Figure 3 (a): Image of *Curcuma angustifolia* Roxb. by John Fleming, licensed under CC BY 4.0. (b) Image of young plant of *C. angustifolia* Roxb. (c) Rhizomes of *C. angustifolia* Roxb.

Description of *Vanshlochan* in Ayurveda

In Sanskrit, *Vamsharocana* (concretion occurring in *Vamsha*), *Vamshi* (obtained from bamboo), *Tugakshiri, Tuga*, *Shubha* (good medicinal qualities), *Tvakkshiri, Vamshaja, Shubhra* (white in appearance), *Vamshakshiri* (farinaceous substance) and *Vainavi* (derived from bamboo) are synonymous of *Vanshlochan*[28,37]. *Vamsharocana* has a sweet flavour and a cool potency. It provides potential to body fitness and strength while, also helping with excessive thirst, cough, fever, dyspnoea, consumption, blood problems, and jaundice. It is also beneficial in skin problems, ulcers, and anaemia, and its astringent activity helps with dysuria caused by *Vata dosha*[28].

Tugakshiri is *Hima* (cold in potency), *Swadu* (sweet in taste), *Balya* (tonic), *Vṛshya* (aphrodisiac) and *Bṛmhana* were the Ayurvedic properties of *Vanshlochan. Raktapitta,* anorexia, asthma, cough, leprosy, fever, anaemia, jaundice, hyper-thirst, burning sensation, wound, dysuria, emaciation [29,31,32], *Vata* alleviation [14], *Pitta*-associated disorders, and as blood purifier are all treated with it[30].

Many Ayurvedic treatises describe *Tavakshiri*, including Bhavaprakasha[14], Kaideva Nighantu[29], Rajanighantu[30], Laghunighantu[31], Chandra nighantu[32], Charaka samhita[33], and Ashtanga samgraha[13]. The attributes of *Vamsharocana* and *Tavakshiri* are discussed individually in Ashtanga samgraha. It appears to be limited to the bamboo product. Dhanvantari Nighantu[34] refers to it as "*Vamsakshiri smrta vamshya yavaja yavasambhava*".

Along with *Vamshakshiri*, the compiler has mentioned several varieties of *Kshiri*. Many researchers considered *Vamsharocana* as concretions from the bamboo and *Tavakshiri* as the starch derived from the rhizomes of *Curcuma angustifolia* Roxb., also used as a substitute for authentic arrowroot of *Maranta arundinacea* Linn.[35,36]. In addition, *C. angustifolia* Roxb. is an indigenous plant, although *M. arundinacea* Linn. is not. Tavakshiri seems to be applied nowadays to any farinaceous material produced from the plant. The etymological meanings of the terms *'Tvaksaraḥ', 'Tavakshiri', 'Vamshaksiri'* in Sanskrit and '*Tabashira'* of *Hakims* indicate that it is a starch produced from bamboo and may differ from concretions gathered in bamboo nodes.

Vamsharocana (the concretions collected at the nodes) is not readily obtained, and not all bamboo species can generate it. It was previously brought from Java, Singapore, and other places in the last century. It was also claimed that the concretions formed as a result of insects perforating the bamboos. Imitating this i.e., by creating a tiny puncture above a spot in half grown bamboos allows the creation of concretions to occur freely. About 60-70 years ago, two variants were available in the market: white and bluish white. At the moment, the market only offers a synthetic preparation.

Table 1: Ayurvedic properties and composition of *Vanshlochan*

Ayurvedic Properties	
Rasa (Taste)	*Madhura* (Sweet) (Kaiyadeava-Nighantu), *Kasaya* (Astringent) (Bhavaprakasha-Nighantu)
Anurasa (After taste)	*Kasaya* (Astringent)
Guna (Main Quality)	*Laghu* (Light), *Ruksha* (Dry) (Bhavaprakasha-Nighantu)
Virya (Potency)	*Sheeta* (Cold) (Kaiyadeva-Nighantu)
Vipaka (Resultant)	*Madhura* (Sweet) (Bhavaprakasha-Nighantu)
Prabhav (Therapeutic Effect)	Rejuvenation and Supplement (Bhavaprakasha-Nighantu)
Dosha Karma (Effect on Humours)	*Kaphapitta Shamaka* (Pacifies *Kapha* and *Pitta*) (Bhavaprakasha-Nighantu)
Composition	
Components	Percentage
Cellulose	41 to 44
Pentosans	21 to 23
Lignin	26 to 28
Silica (SiO_2)	70 to 90
Ash	1.7 to 1.9
Lime- Calcium Oxide (CaO)	Traces
Potash-Potassium Chloride (KCl)	Traces
Iron Oxide (Fe_2O_3)	Traces
Aluminum	Traces
Glucosides	K.N.A
Water	-

Curative Properties of *Vanshlochan*

Vanshlochan or *Tabasheer or Tugaksheeri* is a major constituent of drugs useful for bronchitis, asthma, febrifugal, demulcent, poisoning cases, paralytic complaints, cardiac disorders, venereal diseases, small pox and measles, and hemostatic properties among other things. It is also a valuable element in Ayurvedic formulations such as *Sitopaladi*, *Talisadi*, *Dadimashtaka*, *Vilwadichurna*, and *Chyawanprash*. *Sitopaladi churna* is a popular medicine that is manufactured[38] by combining crystal sugar with *Cinnamomum zylanicum* Blume (*Sita*), *Elettaria cardamomum* (L.) Maton (*Taja*), *Piper longum* L. (*Pippali*), and *Bambusa arundinacea* (Retz.) Willd. (*Tugaksheeri*).

Vanshlochan is also used to treat respiratory infections, cough, tuberculosis, sinus congestion, sore throat, as well as the common cold[39]. Some of the major pharmacological activities of *Vanshlochan* are mentioned below:

Diabetes Management

In chloroform and ethyl acetate fractions, phytochemical analysis revealed the presence of glycosides, flavonoid contents, polyphenols, and triterpenes[25]. When compared to regular glibenclamide, culms of *B. arundinacea* (Retz.) Willd. were discovered to possess anti-diabetic potential[40].

Anti-microbial property

Depending on the dosage, the "water-phase-extract of bamboo silica chips" has the potential to inhibit *Saccharomyces cerevisiae*, *Penicillium citrinum*, *Aspergillus niger*, *Escherichia coli*, *Bacillus subtilis*, and

Staphylococcus aureus growth. Using the two-fold dilution procedure, the lowest inhibitory concentration of "water-phase extract-of-bamboo-silica-shavings" against tested strains of bacteria was in the range of 4.9-32mg per milliliter[41].

Regulatory Approvals to *Vanshlochan*

Regulatory approvals, safety, efficacy, standardization, and quality control are key problems for Indian traditional medicine. As a result, evidence-based scientific research is required to assess *Vanshlochan's* therapeutic efficacy and safety. *Vanshlochan* is an ancient element in Indian traditional medicine; it is time to reconsider the several clinically well-documented indications in form of reverse-pharmacology, molecular biology, proteomics, metabolomics, and networking pharmacology. Given that intracellular biological silica is generally Al-free, the presence of substantial portions of aluminum in epithelial bamboo silica is particularly intriguing[42,43]. For example, MAS NMR ('7Al has 100% isotopic abundance), which detects aluminum readily in hydrated samples (in which the compositional line widening is lowered), fails to detect any aluminum in silica derived from rice husk pyrolysis.

Different Scientific Evidences of *Vanshlochan*

Vanshlochan {*Bambusa arundinaceae* (Retz.) Willd.} is a valuable plant product with pharmacological properties such as anti-inflammatory, carminative, anti-diabetic, antioxidant, aphrodisiac, astringent, and many others[44]. *Vanshlochan*'s active constituents, according to recent literature, are adipic acid ester, α-elemol, palmitic acid and coumarin. Different researchers have worked on the chemical profiling and biological profiling of *Vanshlochan.* This product has shown various properties when exposed to different stimulus and hence possess different medicinal properties, which are evident from various studies carried out in the past. Tab. 3 illustrates some properties of *Tabasheer* when exposed to different compounds and materials:

Table 2: Effect of different materials and their interactions with *Vanshlochan/Tabasheer/Tugaksheeri*

Broad area of study	Parameters observed	Key observations	References
Fame study on chemical reactions with *Vanshlochan/Tabasheer*	Water (H_2O)	Formation of air bubbles Change of appearance from bluish white to transparent	[45]
	Vegetable colors	No reaction with vegetable colors	
	Fire	No Ignition of substance Complete loss in taste	
	Acids	No effervescence or visible changes in appearance after complete immersion	
	Liquid alkalis	Readily dissolved after absorbing alkaline taste	
	Dry alkalis	Yielded a transparent glass like bead or pearl	
Structural studies of *Tabasheer* and *Bambusa*	X-ray diffraction	Broad hump with a maximum at about 22°C	[46]
	X-ray fluorescence	Silicon is the major component with small amounts of aluminium, calcium and magnesium and traces of phosphorus	
	Thermogravimetric analysis	Weight loss after heating at 250°C and above elucidated same pattern as mineral Opal	
	Solid-state NMR	Presence of small amount of aluminium in sample. All aluminium is 4-coordinate	
Microscopic and heavy-metal analysis	Microscopic Analysis	Rosette crystals resembling Calcium oxalate	[47]
	Heavy-Metals Analysis	Presence of Silica (85.78%) Absence of toxic heavy metals such as Arsenic, Cadmium, Mercury and Lead	

Enumeration of Controversy over Adulteration and Substitution

Sandigdha Dravyas, often known as controversial medications, are those plants that are referenced in classical Ayurvedic texts but whose botanical identity is unclear. Many names for an herb have been used in Ayurvedic and Sanskrit literature to characterize them. These synonyms frequently refer to the herb's medicinal properties rather than its exact botanical source[48]. Ayurvedic lexicons provide several synonyms for a single herb based on its form, habitat, origin, medicinal use, and other factors using diverse similes, which are the main sources of contention[30]. Ayurvedic and other Sanskrit literature provided a wealth of information that included several instances when two or more completely distinct plant species were given the same common name in the old medical systems of Ayurveda and other cultures[4]. Both *C. angustifolia* Roxb. and *B. arundinacea* (Retz.) Willd., which are entirely distinct herbs, are referred to as "*Vanshlochan*" or "*Tabasheer*." In accordance with the regional languages, synonyms for plants are also provided. Since, India is a nation with many diverse languages and populations that rely on various forms of folklore and tribal medicine, this is sometimes to be blamed for the misunderstanding of plant names across various species.

The transmission of knowledge in the ancient times was mainly through verbal transmission, also known as *Shruti parampara* in the ancient times. Since there was no printing press in the past, the manuscripts were hand-written in *Bhurja-Patra*, *Taal Patra*, or other durable materials for envisaging and storing the knowledge in a documented form, much of the vital information has been either lost or mis-interpreted in due course of time. Editors or translators may have made mistakes when duplicating these documents, which eventually sparked disputes[49]. In Ayurvedic lexicons, two or more plants that have completely distinct morphologies are described by a single synonym, which raised doubts. Generally, these kinds of customs emerged throughout the Nighantu times. For instance, in addition to *B. arundinacea* (Retz.) Willd. and *C. angustifolia* Roxb., *Vanshlochan* is used for both species[50, 51].

Vanshlochan, herbal silica concretion with the scientific name *B arundinacea* (Retz.) Willd. that is derived from the nodes of female bamboo trees, is a commonly cultivated plant across Asian nations, including India, the Philippines, China, etc., where the temperature and humidity are appropriate. In Eastern nations like India, China, etc., *Vanshlochan* has been gaining popularity as a drug since ancient times. Due to its mode of occurrence, China has declared it to be "fossil teeth of china" and belemnites (also known as "thunderbolts")[52]. The Arabian Physicians are primarily responsible for introducing Western Europe to *Tabasheer*, however, Patrick Russell (Vizagpattanam) claims of bringing *Tabasheer* to Europe[53]. According to Prof. Edward Turner, there are three different forms of *Tabasheer*: chalky, translucent, and clear. He also asserted that Indian *Tabasheer* is made completely of silica with a very small amount of lime and plant debris which enumerates similar properties to as of *Vanshlochan*[54].

Adulteration is the process of partially or completely replacing an original, unsophisticated medicine with another substance that looks similar but has inferior or no chemical or therapeutic characteristics[1]. The adulteration can be purposeful, direct, or unintentional, indirect, depending on the motive. Adulteration, whether direct or deliberate, is typically carried out for financial gain[55]. While inferiority refers to the inclusion of any substandard drug, spoiling is caused by bacteria or parasite infestation. Sophistication is a deliberate type of adulteration in which an entirely different ingredient is substituted for the original drug[1]. This sort of adulteration is similar to original crude medications in that it uses intentionally synthesized substances. This sort of adulteration is used for more expensive medications. One of the most common example is calcium carbonate compound used by name of "*Vanshlochan*"[56]. In addition to the decreased availability of *Vanshlochan*, finding its authentic source is now more difficult due to prevalent adulteration. Ayurvedic doctors and devotees are greatly affected by the sale of artificially manufactured *Vanshlochan* in Indian markets. The ingredients sodium silicate and ammonium silicate are used to make artificial *Vanshlochan*. Water is used to combine these two compounds after that, the mixture is let to dry. The substance is offered as *Vanshlochan* after the drying process[9].

Based on similar pharmacological effects and therapeutic applications, analogous medications are substituted for the original pharmaceuticals in the substitution process. *Abhava Pratinidhi Dravya* is the Ayurvedic term for substitute drugs[57]. The concepts of adulteration and substitution did not exist throughout the *Samhita* Period, although they did so later on. However, according to classical Ayurvedic lexicon, *Dravya* with a comparable *Rasa* (taste), *Guna* (characteristic), *Virya* (potency), and *Vipaka* should be employed in the absence of the others. Therefore, *Abhava Pratinidhi Dravya* is essentially a substitute for the original medication with identical *Rasa*, *Guna*, *Veerya*, *Vipak*, and a focus mostly on *Karma*[58,59]. Being expensive, difficult to get, and naturally found in little quantities, it is now uncommon to find genuine

Vanshlochan on the market. Therefore, synthetic *Vanshlochan* is frequently utilized in the manufacture of Ayurvedic medications as a replacement. As an alternative for *Vanshlochan*, the starch of arrowroot (*M.arundinacea* L.) and East Indian arrowroot, *Tvakshiri* or *Tugakshiri* (*C. angustifolia* Roxb.) which is white in color, are also occasionally employed. However, genuine and synthetic *Vanshlochan* have quite different compositions, qualities, and impacts on health.

Some of the medications specified in the Ayurvedic vocabulary are no longer available, thus alternative pharmaceuticals with comparable therapeutic effect are used in their place[60]. For instance, since *Vanshlochan* is no longer widely accessible, artificial *Vanshlochan* made from sodium and ammonium silicate is currently offered for sale in the Indian market. For example, several species of Bamboo such as *B. arundinacea* (Retz.) Willd. (70-90% silica content)[61], *Dendrocalamus strictus* (Roxb.) Nees (1.8-4.0% silica content)[62] and *C. angustifolia* Roxb., *M. arundinacea* L. have only trace amts. of silica content[63,64] and are taken into consideration for the herb *Vanshlochan*. These species have been described in Ayurvedic classics but whose botanical identification is unclear[65]. Therefore, in conclusion, "*Tabasheer*" the starchy substance derived from *C. angustifolia* Roxb. serves as a substitute for a siliceous component (*Vanshlochan*) derived from *B. arundinacea* (Retz.) Willd, however the problem with *Vanshlochan* is that, it is one of the medications regularly used in Ayurveda and is rarely found to be genuine. Therefore, Vanshlochan's quality control is required on a priority basis.

DISCUSSION

The debate, adulteration, and substitution are all linked with each other. Substitution practices, if practiced for a long period, may hide the identification of the original substance, and the substitute will be regarded the original, causing dispute[66,4]. Adulteration is caused by the inaccessibility and high market price of crude medications. Similarly, owing of a lack of adequate certification, medications with comparable morphology or therapeutic properties may be practiced due to the disagreement about the legitimate botanical source of medicinal plants linked to traditional Ayurvedic literatures[55]. Controversy, adulteration and substitution create problems for standardization of Ayurvedic practices and herbal products. Due to the scarcity of authentic drugs as a result of natural processes, global warming, improper farming practices, etc., substitute medications must be used immediately[67]. Although only endangered and red-listed species should be substituted, the primary component of a preparation shall not be substituted. It should be verified in a modern setting utilising both Ayurvedic principles and modern scientific instruments[68]. The World Health Organisation recommends rejecting any batch of raw material that contains more than 5% of any other plant part of the same plant (e.g., stem in leaf drugs), regardless of whether they are derived from the authentic plant. Adulteration, whether deliberate or inadvertent, should be rejected under certain conditions. Collectors, suppliers, and merchants should be educated on where to find genuine drug sources. By aggressively enforcing regulatory requirements, intentional adulteration should be prohibited. The biggest problem with the promotion of herbal remedies is drug adulteration in market samples, which has led to a drop in faith in Ayurvedic practices and medications[69]. As a result, for the goal of quality, safety, and standardization of Ayurvedic goods and practices, the debate, substitution, and adulteration of pharmaceuticals should be resolved in order for its global acceptability[70]. The primary factor in resolving the controversy is proper authentication of botanical sources of medicinal herbs mentioned in classics; for this, a literature review, ethno-botanical survey, medicinal plant survey, and drug evaluation (morphological, microscopic, chemical, physical, and biological evaluation) should be performed. Similarly, several processes of drug evaluation should be used to determine and detect adulteration. Drug substitution should be proposed only when the therapeutic effectiveness of the replacement medicine is comparable to the original. The uniformity in the selection of crude drugs for pharmaceutical preparations and practices should maintain the standardization of Ayurvedic products, and for this 'Ayurvedic Pharmacopoeia of India' (API) and 'Ayurvedic Formulary of India' (AFI), which play a critical role, should include the greatest number of medications described in the classics and used traditionally[71].

The polynomial system of nomenclature in ancient books is mostly responsible for drug controversy. Although the *Naama-Roopa* (nomenclature and morphology) of medications is apparent in *Samhitas*, debate has arisen owing to *Paryaya* (synonyms) offered by various *Nighantus*. Even now, proper identification of the original plant source remains a significant challenge. Adulteration and substitution are not the same thing. Pharmacological action, rather than form or phytoconstituents, is the most important criterion for replacement. Herb substitution is essential; as more than 44 Indian medicinal plants have been red-listed[72]. Adulteration is a malpractice that occurs not only purposefully but also unintentionally as a result of

the engagement of inexperienced employees in collection and commerce. The debate over the actual botanical sources of medicinal plants discussed in traditional Ayurvedic literature, as well as the issues of substitution and adulteration, should be resolved by integrated research, and those sources should be confirmed that have more potency for the specified pharmacological activities.

Ayurvedic traditions and the herbal business are currently plagued by the adulteration and substitution of natural remedies. One of the biggest problems in the marketing of Ayurveda and herbal goods is the erosion in trust in herbal medicines because of adulteration. Additionally, adulterants cause health risks or negative outcomes. Similar to this, disagreement in common validated formulation is making it difficult for Ayurvedic goods to be uniformly standardized and reliable, and because of the usage of substitutes, it is challenging to get the same benefits that the modern pharmaceuticals may produce.

CONCLUSION

This review provides a critical analysis of the substitutes and adulterated forms of the traditional Ayurvedic medicine *Vanshlochan* or *Tabasheer,* which is a product of the siliceous concretions of *Bambusa* sp. and primarily derived from *B. arundinacea* (Retz.) Willd. This herbal compound has been used and prescribed by Ayurvedic as well as Unani practitioners since antiquity for several indications such as anti-microbial activity, anti-oxidant activity, anti-diabetic, anti-pyretic, anti-inflammatory activity, aphrodisiac, etc. However, without proper documentation and research based standard protocol for quality control of herbal drugs or compounds like *Vanshlochan/ Tabasheer*. It is almost impossible to globalize the benefits of herbal drugs. Adulteration and unavailability of quality raw materials has become a big problem in today's scenario and curbing these malpractices must be the prime concern for regulatory authorities. The absence of silica content in much substituted alternative species of *B. arundinacea* such as *D. strictus*, *M. arundinacea, C. angustifolia* eliminates the beneficial effects of *Vanshlochan* as anticipated by health seekers. Looking at the contemporary state of livelihood, it is imperative to incorporate herbal and organic food supplements for achieving longevity and wellness in life. Therefore, stringent evidence-based research in the field of herbal drugs and formulations with a uniformly validated protocol is the need of the hour. Achieving these goals will enhance the reach of traditional medicinal systems.

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