



(REVIEW ARTICLE)



Effect of a selected *Ayurvedic* herbal formula in the management of *Dadru Kushta* (Tinea): A critical analysis

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Abstract

Most people experience skin conditions like *Dadru* (ring worm) on a daily basis. The skin is the biggest organ in the human body and protects the body from pathogen invasion. In Ayurveda, all skin disorders were addressed under the term *Kushta* (skin diseases). *Dadru* is one of the most common skin disorders according to Ayurveda. The affected population is 15% of the total. *Cassia fistula* (*Āragvadha*) grinded with *Kādi* (Vinegar) was the chosen paste from an authentic text and this review's objective was to investigate how this selected paste from the *Bhaisajyaratnāvali* text manages to treat *Dadru*. Information about *Dadru* was acquired from *Ayurvedic* scriptures, contemporary texts and earlier research studies (from primary and secondary sources). A survey of the literature was done on this paste and examined for their *Pancha Padārtha* (5 elements of herb) and pharmacological qualities regarding in the management of *Dadru*. *Ayurvedic Pancha Padārtha* study has revealed that selected paste has anti-fungal effects. The majority of studies have demonstrated the anti-fungal effects of selected paste, but some articles have also highlighted additional qualities that aid in lowering infection in *Dadru* having individuals. According to a literature review and *Pancha Padārtha* analysis selected paste is useful in the treatment of *Dadru*.

Keywords: *Dadru*; *Kushta*; *Pancha Padārtha*; Skin

1. Introduction

The prevalence of skin illnesses in tropical and developing countries has considerably increased in recent years as a result of numerous causes including poverty, poor sanitation and sanitary conditions, pollution, etc. One of the most prevalent skin conditions *Dadru* is a fungal disease caused due to the fungus *Tinea* ^[1]. *Tinea corporis*, popularly known as "Ringworm," is a superficial dermatophyte infection of the skin, with the exception of the hands, feet, scalp, beard, face, groin and nails (which are all affected by *Tinea manuum*, *Tinea pedis* *Tinea barbae*, Onychomycosis or *Tinea unguium*). Dermatophytes from one of the three genera, *Trichophyton* (which causes infections on the skin, hair and nails), *Microsporum* (which causes infections on the skin and hair) and *Epidermophyton* (which causes infections on skin and nails), are the most prevalent causes of *Tinea corporis* ^[2]. There are family and genetic predispositions to fungal infection that may be mediated by certain flaws in innate and adaptive immunity and not everyone is equally susceptible to fungal infection. Patients with low levels of defensin beta 4 may have a propensity for all dermatophytes. Inherent conditions including diabetes mellitus, lymphomas, immunocompromised state, Cushing syndrome, excessive

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sweating or advanced age are some more risk factors [3]. The various dermatophyte strains can be distinguished using a number of cutting-edge methods, including polymerase chain reaction (PCR) and mass spectroscopy. Topical antifungals are used in the management of limited disease, while oral therapy is often only used in the treatment of more severe instances. Chronic dermatophyte infections of the skin have become more common over the past few years and they have proven challenging to treat. However, systemic antifungal therapy is frequently empirical because there are no current national or international standards for the management of *Tinea corporis*, *cruris* and *pedis*. Therefore it is important to review selected formulas in the management of *Dadru* [4]. However, when the infected areas are big, macerated with a secondary infection or in people with impaired immune systems, systemic therapy also necessary. The best way to prevent *Tinea* infections is to maintain good personal cleanliness, keep the skin cool and dry at all times and refrain from exchanging towels, clothes or hair accessories with those who have the infection [5].

Body ringworm typically manifests as mildly itching, asymmetrical, scaly patches with a clearing in the center and an approaching, elevated edge [6]. *Tinea corporis* has diverse clinical characteristics, so it should be considered when making a differential diagnosis of any red, scaly rash [7].

Skin conditions are categorized in Ayurveda as *Kushta Rōga*, which was further divided into *Mahā Kushta* (major skin illness), has seven different types and *Kshudra Kushta* (minor skin disease), which has eleven different types [8]. *Kandu* (itching), *Utsanna* (elevated circular lesions), *Mandala* (circular patches), *Rāga* (erythema) and *Pidaka* (Papule) are some of the main *Lakshanās* (features) of *Dadru*. The *Pitta-Kapha Dōshas* (body humors) are primarily vitiated and the *Rasavaha* and *Raktavaha Strōtas* (types of body channels) are *Dushti* (vitiating) in the *Samprapti* (pathogenesis) of *Dadru*. *Shōdhana* (cleaning), *Shamana* (pacifying) and *Bahirparimarjana* (topical) *Chikitsā* (treatment) were recommended in Ayurveda for *Dadru* [9].

It was classified as a *Mahākushta* by *Ācharya* (teachers) *Susruta* and *Vāgbhata* and it was explained as a *Kshudra Kushta* by *Ācharya Charaka*. *Dadru* has been referred to as *Kapha Pradhān Vyādhi* (disease predominated) by *Ācharya Susruta* and *Pitta-Kapha Pradhān Dōsha* (body humors) by *Ācharya Charaka* [10]. *Dadru* was discussed in *Vruddatraya* (3 major classical books) and *Laghutraya* (3 minor classical books) according to Ayurveda. *Charaka Samhitā*, *Susruta Samhitā* and *Astanga Hrdaya Samhitā* (classical texts) are examples of *Vruddatraya*. According to *Charaka Samhitā* seven materials affected morbidly are the causative source of *Kushta* such as *Vāta Pitta* and *Kapha* [11]. According to the *Susruta Samhitā*, all varieties of *Kushta* are having the involvement of *Vāta*, *Pitta*, *Kapha* and *Krimi* (worms/bacteria), recognition of these is at the time of their predominance [12]. According to *Ashtānga Hrdyam*, Skin patches long and wide the blade of *Durva* grass has the color similar to that of the flower of *Atasi* (linseed), raised, round patch with itching persisting for a long time are the features of *Dadru Kushta* [13].

Sārangadhara Samhitā, *Bhāvaprakāsha* and *Mādhava Nidāna* are all part of the *Laghutraya*. According to *Sārangadhara Kushta Rōga* (leprosy and allied skin conditions) were eighteen types [14]. According to *Bhāvaprakāsha Dadru Kushta* was a *Kshudra Kushta* because its root is not deep [15]. According to *Mādhava Nidāna Dadru Kushta* was characterized by reddish papules [16]. Paste was selected from an authentic text, *Bhaisajyaratnāvali* and it is mentioned in *Kushtarōga Cikithsāprakaranam*. Paste chosen from this authentic book, contain *Āragvadha* (*Cassia fistula*) grind with *Kādi* [17]. The current study based on an *Ayurvedic* medicinal formula that used in *Dadru* that written over *Bhaisajyaratnāvali*. The study was critically analyzed the pharmacological activities of the ingredients in selected formula in the management of *Dadru*.

Aims & objectives

The study was created to determine the anti-fungal activity of the ingredients in selected paste in the management of *Dadru*

2. Research methodology

The literary review was referred through authentic Ayurveda classics such as *Bhaisajya Ratnāvali*, *Charaka Samhitā*, *Susruta Samhitā*, *Ashtanga Hrdaya Samhitā*, *Mādhava Nidāna* also from *Sārangadhara Samhitā*, *Bhāvaprakāshaya*, Ayurveda Pharmacopiea, Kumar & Clark Clinical medicine and Davidson principle and practice of Medicine. The review on *Dadru* and paste was conducted through recent scientific explanations and findings which published in official websites and indexed journals, articles, books, reports of WHO and encyclopedias. The gathered information was compared with traditional and modern scientific explanations using based on pharmacological characteristics, *Rasa* (taste), *Guna* (quality), *Veerya* (potency), *Vipāka* (last taste) and *Prabhāva* (specific action).

2.1. Review

Herbal paste chosen from an authentic book, *Bhaisajyaratnāvali* has two ingredients: (Table 1).

Table 1 Review of selected paste

Ingredients	<i>Cassia fistula</i>	Vinegar
Family	Caesalpinaceae	-
Sanskrit name	<i>Āragvadha</i>	<i>Kādi</i>
Part used	Fruits, stem bark and leaves	-

2.2. *Cassia fistula* (*Āragvadha*)

An average-sized deciduous tree, *Cassia fistula* is 10 meters tall, has yellow flowers, alternate, pinnate leaves, and has 4–8 pairs of ovate leaflets that are 7.5–15 cm long and 2–5 cm wide. Pendulous, cylindrical, brown, septate fruits that are 25–50 cm long, 1.5–3 cm wide, and have 25–100 seeds. Lenticular, light brown and glossy seeds. In India, China, Hong Kong, the Philippines, Malaysia, Indonesia, Thailand and many other Asian nations where it grows, *Cassia fistula* is used as a traditional herbal remedy. This plant's fruits, stem bark and leaves are full of biologically active substances like anthraquinones, flavonoids, flavon-3-ol derivatives, alkaloids, glycosides, tannin, saponin, terpenoids, reducing sugar and steroids, all of which have a range of therapeutic benefits. The fruit and stem bark extract has numerous biological effects including antipyretic, anti-inflammatory, anti-oxidant, anti-diabetic, hypolipidemic, hepatoprotective, antibacterial, anticancer and antiulcer and properties [18].

Cassia fistula has *Madhura* (sweet) in *Rasa*, *Mrudu* (soft), *Guru* (heavy), *Snigdha* (oily) in *Guna* (quality), *Madhura* in *Vipāka* (last taste), *Sheeta* (cold) in *Veerya* (potency), *Vāta Pitta Shāmaka* (reduce body humors) and *Sramsana* (mild purgation) in *Prabhāva* (specific action) [19].

Phongpaichit et al (2004) study indicated that all selected pathogenic fungi that were inhibited by all three extracts from *Cassia* leaves. The results supported the traditional medicinal claims that these herbs can treat ringworm and skin conditions [20]. Multiple extractions, column chromatography-based fractionation, preparative thin-layer chromatography (TLC) and liquid chromatography/mass spectrometry purification were used to isolate the active components. Mass spectrometry data was used to determine the structure of isolated molecules. Roseanone was one of the substances found. The existence of roseanone with anti-yeast activity was established by the analysis of the active fraction from *Cassia fistula* seed extract. *Cassia fistula* seeds exhibit pharmacological action that includes anti-fungal effect. They have been utilized as an herbal remedy [21] [22]. The highest percentage of growth inhibition (64.3%), when measured, was found in the bark and leaf extract of *Cassia fistula*. According to the research, leaf and bark extracts have broad-spectrum action and may be used to treat infectious disorders [23].

Bhalodia et al (2011) this study's objective was to evaluate the antibacterial activity of extracts and identify their zone of inhibition on a variety of bacterial and fungi strains. In the current investigation, the potential antibacterial activity of hydro alcohol extracts of the leaves of the ethno medicinal plant *Cassia fistula* was assessed against medically significant bacterial and fungus strains [24]. The hydro alcoholic and chloroform extracts of *Cassia fistula* were found to be more effective than conventional medications in the current studies on several isolated microorganisms and fungi [25]. Tribal people frequently utilize this herb to treat ringworm and other fungal skin infections among other ailment. Traditional people utilize the entire plant to treat diarrhea; the seeds, blossoms and fruits are used to treat skin conditions, fever, abdominal pain and leprosy [26].

Methanolic extraction of plant showed notable antifungal activities against *Aspergillus niger*, *Aspergillus terreus*, *Aspergillus flavus*, *Aspergillus fumigatus*, *Candida albicans*, *Saccharomyces cerevisiae*, *Fusarium sp.*, *Microsporium canis*, *Streptococcus faecalis*, *Mucor sp.*, *Penicillium expansum*, *Trichoderma viride*, *Trichoderma horzianum* and *Trichophyton mentagrophytes* [27].

It is renowned as a plentiful source of glycosides, flavonoids, and tannins. Antibacterial, anti-diabetic, antifertility, anti-inflammatory, antioxidant, hepato-protective, anticancer and antifungal actions are among the pharmaceutical effects

2.3. *Kādi* (Vinegar)

A natural product called vinegar is produced through the fermentation process. Foods high in carbohydrates are great sources of the substrate needed to make vinegar. Due to its flavor and scent, vinegar is mostly utilized as a food ingredient and can give as an *Anupāna* (drink take) to enhance actions. It is one of the most well-known traditional treatments for infections. According to several studies, vinegar may help with conditions like cancer, obesity, diabetes, cardiovascular disease and microbial infections. It has been suggested that daily consumption of a beverage containing 15 ml of vinegar (750 mg of acetic acid) can reduce the risk of lifestyle-related disorders like obesity, hypertension and hyperlipidemia. Acetic acid and other ingredients in vinegar may be the cause of its medicinal effects. Since Ancient Greece era, vinegar has been used generously as an antifungal and anti-micro bacterial due to its extreme low-pH in presence of acetic acid as main constituent [28].

Vinegar has *Amla* (sour), *Katu* (pungent) *Rasa*, *Laghu* (lightness), *Rūksha* (dry) *Guna*, *Ushna Veerya* (hot potency), *Amla Vipāka* (last taste is sour) and *Pitta Kapha Shāmaka* action (reduce body humors).

Vinegar has been shown to have antifungal activity, making it a potential therapeutic option for people with skin diseases [29]. Vinegar was one of the ancient foods utilized as folk medicine during the time of Hippocrates because it was used to cure wounds [30]. In contrast to nystatin, which demonstrated fungistatic activity, alcohol vinegar demonstrated 75% and 62.5% of 2.5 mg/ml, with fungicidal impact from 120 min [31]. The results showed that both bacterial strains and fungal isolates are very susceptible to the examined vinegar, particularly sample. When compared to the other samples, sample1 had the highest acidity and phenolic content, according to the findings analysis [32]. When 18 samples were tested, 13 (72%) were found to have fungal growth; 6 of them had *Aspergillus niger*, 1 contained *Aspergillus flavus*, 2 contained *Candida albicans*, and the remaining 4 contained non-*Candida albicans* [33]. Agar plates containing more than 2.5% neutralized wood vinegar demonstrated potent antifungal action against sapstaining fungus [34]. Fungal growth was significantly slowed down by vinegar. These findings demonstrated that, a white-rot fungus, was more harmful to vinegar than, a brown-rot fungus. The findings revealed that strong antifungal action was caused by phenolic chemicals from lignin breakdown [35]. Vinegar contains acetic acid, which has antimicrobial, antifungal, and antiviral effects [36].

3. Results and discussion

The states of *Dadru* and skin diseases (*Tinea*) were described in various ways by various *Ācharyas*. *Charaka Samhitā* and *Susruta Samhitā* included primary causes of ringworm while *Ashtānga Hrdaya* explained features of *Dadru Kushta*. Various definitions were given in *Mādava Nidāna*, *Sārangadhara Samhitā* and *Bhāvaprakāsha*. Modern treatments like anti-fungal therapy and systemic therapy were mentioned in modern text books. According to Ayurveda and Modern research articles selected paste is effective in the management of *Dadru Kushta*. Most of the research articles have shown that selected paste is anti-fungal while some other articles have included some other properties which in turn help to reduce infection of *Tinea*.

When consider about *Cassia fistula* due to *Madhura Rasa*, *Madhura Vipāka*, *Guru Snigdha Guna* possess *Kapha Pitta Shāmaka*, *Yogavāhi* (Catalyst) and *Krimighna* (reduce worms/bacteria) property and can be used to reduce the features of *Dadru*. When consider about vinegar due to *Katu Rasa Rūksha Guna* it pacifies *Pitta* and due to *Laghu Rūksha Guna* and *Ushna Veerya* it pacifies *Kapha*. As well as *Laghu Rūksha Guna*, *Ushna Veerya* reduce itching because the toxins which localized go out through the *Swēda* (sweat) thus clearing out the micro channels of skin by removing the obstruction in the *Swēdavaha Srōtas* (channels). It's *Laghu*, *Rūksha Guna* and *Ushna Veerya* cause *Lēkhana* (emaciating) leading to the removal of *Klēda* (watery waste) and *Snigdhatā* (oily). *Katu Rasa* acts as *Pitta Shāmaka* and removes *Klēda* from the lesion and surrounding tissues, counters the *Krimi*, scrapes muscle tissue, brings lysis of clotted blood and depresses the wound which will pacify the *Dōshas* (humors) and ultimately leads to breaking the pathogenesis. Also vinegar is Alkalizing and reduces burning sensation. The combination of alcohol and acetic acid is anti-microbial and anti-fungal when applied externally. Also balances normal PH of skin and lighten the skin color.

The literature review indicated that selected paste is anti-fungal in effect. Paste shows anti-ulcer action in turn which reduces the infection of the skin. Another idea is that this selected paste show anti-inflammatory activity and it reduces inflammation during infection of the skin. However, in order to determine whether this selected paste may be used to treat and prevent *Dadru* in humans, more thorough and conclusive human research must be conducted. According to the review, this selected paste a show anti-pyretic, anti-oxidant, anti-diabetic, anti-cancer, and anti-fertility actions.

4. Conclusion

Dadru as an important public health problem has been discussed in recent few decades worldwide. *Cassia fistula* grind with *Kādi* is useful in the control of *Dadru* according to the review of the literature and the *Pancha Padārtha* examination. The previous studies of pharmacological effects have revealed that this paste have strong anti-fungal qualities. There is an urgent need to reduce the prevalence of *Dadru* among people worldwide.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to disclosed.

References

- [1] Reddy AP, Chandane PB, Puri DK, Damle RV, Kathe MS. MANAGEMENT OF DADRU WITH DADRUHARA LEPA AND GANDHAK RASAYANA: A CASE STUDY. 2017;6(16):486-496.
- [2] Leung AK, Lam JM, Leong KF, Hon KL. Tinea corporis: an updated review. *Drugs in context*. 2020;9.
- [3] Yee G, Al Aboud AM. Tinea corporis. 2019.
- [4] Sahoo AK, Mahajan R. Management of tinea corporis, tinea cruris, and tinea pedis: A comprehensive review. *Indian dermatology online journal*. 2016 Mar;7(2):77.
- [5] Gupta AK, Chaudhry M, Elewski B. Tinea corporis, tinea cruris, tinea nigra, and piedra. *Dermatologic clinics*. 2003 Jul 1;21(3):395-400.
- [6] Kumar P, Clark M. *Clinical medicine*. 7th ed., 2009, p. 1323.
- [7] Davidson S. *Davidson principles & Practice of Medicine*. 21st ed., 2010, p. 1247.
- [8] Deshmukh SG, Thakre T, Gupta J, Waskar R. A Case Study on Management of Tinea Cruris with Classical Vaman Karma. *Journal of Pharmaceutical Research International*. 2021 Jun 30;33(33B):195-202.
- [9] Laddha S, Sureka V, Swan P. MANAGEMENT OF DADRU KUSHTHA (TINEA CRURIS) THROUGH AYURVEDA–A CASE STUDY. *World Journal of Pharmaceutical Research*. 2021 Mar 5;10(5):1578-85.
- [10] Pantawane PG, Swan PS. MANAGEMENT OF DADRU KUSHTHA: A CASE STUDY. 2020.
- [11] Sharma RK. *Charaka Samhita, Volume I, Chaukhamba Orientalis, Sanskrit series office*: 2005, p. 276-281.
- [12] Sharma PV. *Susruta Samhita, Volume I, Chaukhamba Orientalis, Varanasi*: 2010, p. 494-502.
- [13] Srikantha Murthy KR. *Ashtangahrdayam, Chowkhambhakrinadas Academy, Varanasi, India*: 2009, p. 136-147.
- [14] Srikantha Murthy KR. *Sarangadhara Samhita, 6th ed., Chaukhamba Orientalis, Varanasi*: 1984, p. 39.
- [15] Srikantha Murthy KR. *Bhavaprakasha, 1st ed., Volume 2, Chowkhambhakrinadas Academy, Varanasi, India*: 2009, p. 500.
- [16] Murthy KR. *Madhava Nidana. 7th ed., Chaukhamba Orientalis*: 2005, p. 161.
- [17] Kaviraj SGDS. *Bhaisajya Ratnavali, 1st ed., Volume 2, Chowkhambhakrinadas Academy, Varanasi, India*: 2014, p. 287.
- [18] Ali MA. *Cassia fistula Linn: a review of phytochemical and pharmacological studies. Int J Pharm Sci Res*. 2014 Jun 1;5(6):2125-30.
- [19] *Ayurveda pharmacopeia, Volume I, Part I, Department of Ayurveda, Colombo, Srilanka*: 1976, p. 23-24.
- [20] Phongpaichit S, Pujenjob N, Rukachaisirikul V, Ongsakul M. Antifungal activity from leaf extracts of *Cassia alata* L., *Cassia fistula* L. and *Cassia tora* L. *Songklanakar J Sci Technol*. 2004;26(5):741-8.
- [21] Jothy SL, Zakaria Z, Chen Y, Lau YL, Latha LY, Shin LN, Sasidharan S. Bioassay-directed isolation of active compounds with antiyeast activity from a *Cassia fistula* seed extract. *Molecules*. 2011 Sep 5;16(9):7583-92.

- [22] Akanmu MA, Iwalewa EO, Elujoba AA, Adelusola KA. Toxicity potentials of Cassia fistula fruits as laxative with reference to senna. *African Journal of Biomedical Research*. 2004;7(1).
- [23] Prabagar S, Nanthakumar J, Thuraisingam S, Prabagar J. Antimicrobial Activity of Leaf and Bark Extracts of Cassia fistula. *World Journal of Agricultural Sciences*. 2020;16(4):227-32.
- [24] Bhalodia NR, Shukla VJ. Antibacterial and antifungal activities from leaf extracts of Cassia fistula L.: An ethnomedicinal plant. *J Adv Pharm Technol Res*. 2011;2(2):104-109.
- [25] Panda SK, Padhi LP, Mohanty G. Antibacterial activities and phytochemical analysis of Cassia fistula (Linn.) leaf. *J Adv Pharm Technol Res*. 2011;2(1):62-67.
- [26] Duraipandiyan V, Ignacimuthu S. Antibacterial and antifungal activity of Cassia fistula L.: An ethnomedicinal plant. *Journal of ethnopharmacology*. 2007 Jul 25;112(3):590-4.
- [27] Kadhim MJ, Mohammed GJ, Hameed IH. In vitro antibacterial, antifungal and phytochemical analysis of methanolic extract of fruit Cassia fistula. *Oriental Journal of Chemistry*. 2016;32(3):1329.
- [28] Samad A, Azlan A, Ismail A. Therapeutic effects of vinegar: a review. *Current Opinion in Food Science*. 2016 Apr 1;8:56-61.
- [29] Mota AC, de Castro RD, de Araújo Oliveira J, de Oliveira Lima E. Antifungal activity of apple cider vinegar on *Candida* species involved in denture stomatitis. *Journal of Prosthodontics*. 2015 Jun;24(4):296-302.
- [30] Ali Z, Wang Z, Amir RM, Younas S, Wali A, Adowa N, Ayim I. Potential uses of vinegar as a medicine and related in vivo mechanisms. *International Journal for Vitamin and Nutrition Research*. 2016 Jun 1;86(3-4):127-51.
- [31] De Castro RD, Mota AC, de Oliveira Lima E, Batista AU, de Araújo Oliveira J, Cavalcanti AL. Use of alcohol vinegar in the inhibition of *Candida* spp. and its effect on the physical properties of acrylic resins. *BMC Oral Health*. 2015 Dec;15(1):1-7.
- [32] Ousaaid D, Laaroussi H, Bakour M, Ennaji H, Lyoussi B, El Arabi I. Antifungal and antibacterial activities of apple vinegar of different cultivars. *International Journal of Microbiology*. 2021 Aug 7;2021.
- [33] Abbas FN, Jabir HB, Khalaf RM. In vitro assessment of antifungal potential of apple cider vinegar and acetic acid versus fluconazole in clinical isolates of otomycosis. *University of Thi-Qar Journal Of Medicine*. 2011;5(1):126-33.
- [34] Velmurugan N, Han SS, Lee YS. Antifungal activity of neutralized wood vinegar with water extracts of *Pinus densiflora* and *Quercus serrata* saw dusts. 2009;3(2):167-176.
- [35] Adfa M, Romayasa A, Kusnanda AJ, Avidlyandi A, YUDHA S S, BANON C, GUSTIAN I. Chemical components, antitermite and antifungal activities of *Cinnamomum parthenoxylon* wood vinegar. *Journal of the Korean Wood Science and Technology*. 2020;48(1):107-16.
- [36] Bansal M, Budhiraja U, Bansal H. Contemporary pursuits of vinegar from scullery to dermatology. *International Journal of Research*. 2020 Sep;6(5):708