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A COMPREHENSIVE PHYTOCHEMICAL, PHARMOCOLOGICAL AND CLINICAL REVIEW OF ANTI-FIBROTIC, ANTI INFLAMMATORY AND ANALGESIC EFFECT BY COMBINED ASITAKADI CHURNA WITH KOLADI CHURNA LEPA IN THE MANAGEMENT OF AVABAHUKA WITH SPECIAL REFERENCE TO ADHESIVE CAPSULITIS

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ABSTRACT

Background: Avabahuka is a Vata-predominant disorder of the Amsasandhi (shoulder joint) described comprehensively in Ayurvedic classical texts, presenting with Bahushula (shoulder pain), Bahustabdata (stiffness), Bahuspandanahara (restricted movement), and Amsabandana shosha (muscle wasting). Its clinical manifestations closely parallel adhesive capsulitis (frozen shoulder), which affects 2-5% of the general population and up to 25% of diabetic patients, with peak incidence between 40 and 60 years.[1,2] **Objective:** This review critically synthesises the Ayurvedic classical textual basis, phytochemical constituents, pharmacokinetic and pharmacodynamic profiles, pharmacological activities, and available clinical evidence for Asitakadi Churna (internal administration) and Koladi Churna Lepa (external application) in Avabahuka/Adhesive Capsulitis, comparing them with Trayodashanga Guggulu as reference standard. **Methods:** A comprehensive literature search was conducted in PubMed, DHARA, AYUSH Research Portal, and all major Ayurvedic

classical texts including Charaka Samhita, Sushruta Samhita, Ashtanga Hrudaya, Ashtanga Sangraha, Vangasena Samhita, Bhavaprakasha, Bhaishajya Ratnavali, and Sharangadhara Samhita. Pharmacological studies and clinical trials related to constituent drugs were reviewed. **Results:** Koladi Churna Lepa (Vangasena Samhita, Vatavyadhi Adhikara, verse 112)[4] comprises eleven drugs with potent local analgesic, anti-inflammatory, Vata-shamaka, and transdermal penetration-enhancing properties. Asitakadi Churna (Bhavaprakasha, Amavata Prakarana, verses 75-77)[5] provides systemic Vatakaphahara, Ama-nashana, anti-fibrotic, immunomodulatory, and Brimhana activities through its seven-drug combination. Trayodashanga Guggulu (Bhaishajya Ratnavali, Vatavyadhi Adhyaya, verse 98-101)[23] provides the comparator standard through Guggulsterone-mediated NF-kB suppression and anti-inflammatory activity. **Conclusion:** Combined Asitakadi Churna and Koladi Churna Lepa offers a multi-modal Ayurvedic therapeutic strategy with mechanistic advantages in anti-fibrotic, anabolic, Ama-nashana, and transdermal delivery properties over Trayodashanga Guggulu. Randomised controlled trials with validated SPADI and goniometric ROM outcome measures are warranted.

KEYWORDS: Avabahuka, Adhesive Capsulitis, Frozen Shoulder, Asitakadi Churna, Koladi Churna Lepa, Trayodashanga Guggulu, Vata Vyadhi, Amsasandhi, SPADI, Vatakaphahara.

1. INTRODUCTION

The shoulder complex, constituting four articulations working in concert — glenohumeral, acromioclavicular, sternoclavicular, and scapulothoracic — provides the greatest range of motion of any joint in the human body. This functional advantage, however, comes at the cost of structural vulnerability, and disorders of the shoulder girdle represent a major source of musculoskeletal morbidity globally.[3]

Adhesive capsulitis (frozen shoulder) is characterised by progressive painful restriction of all glenohumeral movements, resulting from diffuse capsular inflammation, fibrosis, and contracture. The global prevalence is 2-5% of the general population, rising to 25% in diabetic patients.[2] The peak age of onset is 40-60 years with a female preponderance. Long-term outcomes remain unpredictable, with a significant proportion of patients reporting persistent disability at five years despite conventional therapy. The limitations of glucocorticoid injections, physiotherapy, hydrodilatation, and surgical capsular release in achieving complete remission and preventing relapse provide a compelling rationale for exploring Ayurvedic therapeutic approaches.[3]

In Ayurvedic medicine, Avabahuka is a well-documented Vatavyadhi of the Amsasandhi described by Acharya Sushruta in Nidanasthana[7] and Chikitsasthana,[8] Acharya Vagbhata in Ashtanga Hrudaya,[9,10] Vriddha Vagbhata in Ashtanga Sangraha,[11,12] and Vangasena in Vangasena Samhita.[4,13] The disease's cardinal features — Bahushula, Bahustabdata, Bahuspandanahara, and Amsabandana shosha — precisely mirror the pain, stiffness, restricted ROM, and muscle atrophy of adhesive capsulitis.

Koladi Churna Lepa, sourced from Vangasena Samhita,[4] and Asitakadi Churna, sourced from Bhavaprakasha,[5] are Ayurvedic formulations with direct classical indication in Avabahuka. Despite this textual foundation and rational pharmacological basis, no published randomised controlled clinical trial has evaluated their combined efficacy. This review provides the first comprehensive evidence synthesis to support such evaluation, comparing the combination with Trayodashanga Guggulu sourced from Bhaishajya Ratnavali.[23]

2. AVABAHUKA: CLASSICAL AYURVEDIC PERSPECTIVE

2.1 Etymology and Nosological Classification

The term 'Avabahuka' derives from 'Ava' (downward/diminution) + 'Bahu' (arm/shoulder) + suffix, signifying progressive loss of shoulder function. The condition is classified under Vatavyadhi (diseases of Vata dosha), specifically arising from Ruksha, Laghu, Sheeta, and Vishada qualities of aggravated Vata causing Shleshaka Kapha kshaya (depletion of articular lubrication) and Mamsa shosha (muscle wasting) in the Amsasandhi. The cardinal clinical features — Bahushula (shoulder pain), Bahustabdata (stiffness), Bahuspandanahara (restricted shoulder movements), and Amsabandana shosha (wasting of shoulder musculature) — collectively constitute the Ayurvedic clinical picture of Avabahuka, mapping directly onto the four major domains of adhesive capsulitis assessment: pain, stiffness, restricted ROM, and functional disability with muscle atrophy.

2.2 Description in Charaka Samhita

While Acharya Charaka does not describe Avabahuka by name directly, his management of Bahushirogatavata in Chikitsasthana (Chapter 28, Vatavyadhi Chikitsa Adhyaya, verse 18) provides directly applicable principles: Snehana (internal and external oleation), Svedana (sudation), Basti (medicated enema), and Nasya (nasal medication) as the four pillars of Vatavyadhi treatment.[6] These principles directly inform the rationale for the oral administration of Asitakadi Churna (Snehana-Brimhana) and the warm Upanaha application of Koladi Churna Lepa (Svedana) as the combined therapeutic strategy.

2.3 Description in Sushruta Samhita

Acharya Sushruta provides the most comprehensive classical description of Avabahuka. In Nidanasthana (Chapter 1, Vatavyadhi Nidanam, verse 82), he elaborates the nidana (aetiology), samprapti (pathogenesis), and lakshanas — attributing Avabahuka to Vata-driven Shosha (desiccation) of the Shleshaka Kapha and articular Snehana of the Amsasandhi.[7] The Chikitsasthana (Chapter 5, Mahavatavyadhichikitsa, verse 23) prescribes Snehana of the shoulder, Svedana, and warm medicated paste application (Upanaha) as the primary therapeutic interventions.[8] This classical Upanaha prescription directly validates the Koladi Churna Lepa external application protocol of the current study.

2.4 Description in Ashtanga Hrudaya

Acharya Laghu Vagbhata in Ashtanga Hrudaya (Nidanasthana, Chapter 15, Vatavyadhi Nidana Adhyaya, verse 43) describes Avabahuka as 'Bahushoshanam' — progressive wasting and desiccation of shoulder structures from Vata aggravation consuming Shleshaka Kapha.[9] The Chikitsasthana (Chapter 21, Vatavyadhi Chikitsadhyaya, verse 44) prescribes Abhyanga (oil massage), Upanaha (warm medicated poultice to shoulder), Nasya, and internal Vatahara formulations.[10] Vagbhata's Upanaha prescription for the shoulder is the direct classical precedent for Koladi Churna Lepa applied as per Vangasena Samhita. The Snehana-Brimhana principle of Vagbhata's chikitsa informs the selection of Asitakadi Churna as the internal arm of treatment.

2.5 Description in Ashtanga Sangraha

Vriddha Vagbhata in Ashtanga Sangraha (Nidanasthana, Chapter 15, Vatavyadhi Nidana Adhyaya, verse 30) describes Bahu Shosha, Stabdhata, and restricted Cheshtha as cardinal features of Avabahuka, adding Ativyayama (overuse of shoulder) as a precipitating aetiological factor — which corresponds to modern recognition of repetitive overhead work and shoulder trauma as precipitants of adhesive capsulitis.[11] The Chikitsasthana (Chapter 23, verse 28-29) confirms the Snehana, Svedana, Basti, and Nasya protocol.[12]

2.6 Description in Vangasena Samhita

Vangasena Samhita (Vatavyadhi Adhikara, verse 112) is the primary classical source for Koladi Churna Lepa, describing the eleven-drug formulation specifically for management of Avabahuka (Bahushosha), along with the method of preparation and application as Upanaha with Kanji vehicle.[4] The Vangasena reference represents the strongest direct classical textual

authority for the Koladi Churna Lepa application, providing textual validation at the level of disease-specific indication rather than general Vatavyadhi management.

2.7 Description in Bhavaprakasha

Bhavamishra in Bhavaprakasha (Madhyama Khanda, Chapter 9, Amavata Chikitsa Prakarana, verses 75-77) describes Asitakadi Churna in the Amavata context.[5] The direct indication of Asitakadi Churna in Avabahuka is established through: (i) the pathological overlap between Amavata and Avabahuka — both conditions involve Ama-mediated joint damage and Vata-Kapha dushti; (ii) the drug composition's Vatakaphahara and Ama-nashana properties directly addressing Avabahuka samprapti; and (iii) the specific Brimhana and Rasayana drugs (Guduchi, Vishnukranta, Varahikanda) addressing the Shosha dimension of Avabahuka.

3. MODERN CORRELATE: ADHESIVE CAPSULITIS (FROZEN SHOULDER)

3.1 Definition, Epidemiology, and Clinical Features

Adhesive capsulitis is described in Harrison's Principles of Internal Medicine (17th Edition, Volume 2, p. 2185) as a condition characterised by painful restriction of both active and passive shoulder motion in all planes, secondary to diffuse capsular inflammation and fibrosis.[15] Epidemiologically, the prevalence is 2-5% in the general population and up to 25% in diabetic patients, with peak incidence between 40-60 years. Females are more commonly affected than males. Diabetes is the single most important comorbidity, with patients carrying a lifetime risk of 10-20% for developing this condition.[5]

Night pain in the affected shoulder, pain on overhead activities and rotation, and progressive restriction of all glenohumeral movements are cardinal presenting features. The condition may follow shoulder bursitis, tendonitis, post-surgical immobilisation, or thyroid dysfunction.[3] Physical examination reveals restriction of both active and passive ROM in all planes — particularly external rotation and abduction — with positive Hawkins-Kennedy and Neer impingement tests in the inflammatory phase. Goniometric assessment documents the degree of restriction across six planes: flexion (normal 160-180 degrees), extension (40-50 degrees), abduction (160-180 degrees), adduction (40-50 degrees), internal rotation (70-90 degrees), and external rotation (70-90 degrees).[29]

3.2 Pathophysiology and Ayurvedic Correlation

The molecular pathophysiology involves T-cell and mast-cell infiltration of the glenohumeral capsule, activation of capsular fibroblasts by TGF-beta/IL-1beta/TNF-alpha, excessive type I and III collagen deposition, myofibroblast differentiation, and progressive reduction in joint capsule volume. This cascade maps onto Avabahuka samprapti: Vata aggravation (corresponding to pro-inflammatory cytokine activation and neurogenic sensitisation) causes Shleshaka Kapha kshaya (synovial fluid depletion/capsular desiccation), Ama accumulation in joints (corresponding to pro-fibrotic glycoprotein and immune complex deposition), and ultimately Mamsa shosha (muscle atrophy from disuse and inflammatory catabolic signalling).[3]

4. FORMULATION REVIEW: KOLADI CHURNA LEPA

4.1 Classical Source, Composition, and Preparation

Koladi Churna Lepa is sourced from Vangasena Samhita (Vatavyadhi Adhikara, verse 112) and comprises eleven drugs in equal proportion: Kola (*Ziziphus jujuba*, fruit), Kulatha/Surabija (*Dolichos biflorus*, seed), Devadaru (*Cedrus deodara*, heartwood), Rasna (*Alpinia galanga*, rhizome), Atasi (*Linum usitatissimum*, seed), Eranda (*Ricinus communis*, root), Masha (*Vigna mungo*, seed), Kushta (*Saussurea lappa*, root), Vacha (*Acorus calamus*, rhizome), Shatahwa (*Anethum graveolens*, seed), and Yava Churna (*Hordeum vulgare*, grain).[4,19] For preparation: all drugs are fine-powdered individually, mixed, and sieved.[20]

For application (Koladi Churna Lepa as Upanaha): the churna is mixed with Amla Dravya Kanji (prepared from Raktashali rice and Kulmasha fermented in water in a sealed mud pot for 10 days[21]) to form a smooth paste; the paste is heated by water bath; applied lukewarm to the affected shoulder at approximately 4-5 mm thickness (1/3 angushtha)[26,27]; covered and allowed to dry; then removed with warm water — constituting classical Upanaha Sveda as prescribed in Sharangadhara Samhita (Uttarakhanda, Chapter 11, Lepadi Vidhi).[17]

4.2 Phytochemical and Pharmacological Analysis of Koladi Churna Lepa Constituents

4.2.1 Kola (*Ziziphus jujuba*, Indian Jujube — Fruit): Kola (Madhura-Amla rasa, Guru-Snigdha guna, Vata-Pitta shamaka, Brimhana, Shothahara, Vedanasthapana) is the principal drug of the formulation.[16] Phytochemical studies identify cyclopeptide alkaloids (sanjoinine A, nummularine B), triterpenoid saponins (jujuboside A/B, betulinic acid, ursolic acid, oleanolic acid), and flavonoids (quercetin, kaempferol, rutin). Ursolic acid inhibits NF-kB activation and COX-2/iNOS expression in inflamed synoviocytes. Betulinic acid inhibits

TGF-beta-1-induced myofibroblast differentiation in vitro, directly targeting capsular fibrogenic mechanisms in adhesive capsulitis. Jujuboside A modulates GABA-ergic neurotransmission, contributing sedative and analgesic effects — relevant to the nocturnal pain component of adhesive capsulitis.

4.2.2 Kulatha (*Dolichos biflorus*, Horse Gram — Seed): Kulatha (Ushna virya, Tikta-Kashaya rasa, Kapha-Vata shamaka, Shothahara, Anulomana) contributes its Ushna (hot) quality essential for Vata-shamana in the warm Upanaha lepa.[16] Bioactive isoflavonoids (daidzein, genistein, biochanin A) exhibit anti-inflammatory activity through COX-2 inhibition and TNF-alpha suppression. Ushna virya in warm Upanaha application potentiates local vasodilation, enhancing drug delivery to peri-articular structures of the shoulder.

4.2.3 Devadaru (*Cedrus deodara*, Himalayan Cedar — Heartwood): Devadaru (Tikta-Katu rasa, Ushna virya, Kapha-Vata shamaka, Shothahara, Vedanasthapana) is a classical first-choice drug for Vatavyadhi.[16] Sesquiterpene constituents (himachalol, cedrol, alpha-himachalene, deodarone) exhibit significant COX-2 inhibition (cedrol IC50 18.7 mcM), PGE2 suppression, and mast cell degranulation inhibition — blocking the key early inflammatory event in adhesive capsulitis. Volatile terpene constituents function as chemical penetration enhancers, augmenting transdermal flux of co-formulated drugs by 3-8 fold through stratum corneum lipid disorder.

4.2.4 Rasna (*Alpinia galanga*, Greater Galangal — Rhizome): Rasna (Tikta-Katu-Madhura rasa, Ushna virya, Kapha-Vata shamaka, Shothahara, Vedanasthapana) contributes multi-pathway anti-inflammatory activity.[16] 1-Acetoxychavicol acetate (ACA), galangin, kaempferol, quercetin, and essential oil (1,8-cineole, beta-pinene) are principal bioactives. ACA suppresses NF-kB activation and TNF-alpha-induced COX-2 expression. Galangin exhibits COX-2 selective inhibitory activity (IC50 22 mcM). A clinical study by Satoskar et al. demonstrated that topical Alpinia galanga extract significantly reduced joint pain and swelling in musculoskeletal disorders ($n=45$, $p<0.01$).

4.2.5 Atasi (*Linum usitatissimum*, Flaxseed — Seed): Atasi (Madhura-Tikta rasa, Ushna virya, Kapha-Vata shamaka, Shothahara, Vedanasthapana) contributes alpha-linolenic acid (ALA, 45-55% of seed oil), secoisolariciresinol diglucoside (SDG), and mucilage.[16] ALA serves as precursor for anti-inflammatory eicosanoids (PGE3, LTB5) and resolvin/protectin lipid mediators that actively resolve inflammation. Mucilage augments paste consistency and

adherence to shoulder skin, prolonging drug contact time for enhanced transdermal absorption. SDG exhibits anti-inflammatory and oestrogen-modulating activities relevant to peri-menopausal onset of adhesive capsulitis.

4.2.6 Eranda (*Ricinus communis*, Castor — Root): Eranda (Madhura-Katu rasa, Ushna virya, Kapha-Vata shamaka, Shothahara, Vedanasthapana) is the pre-eminent Vatahara drug of Ayurveda.[16] Ricinoleic acid (85-90% of castor oil) inhibits substance P neuropeptide release from peripheral nociceptors, activates EP3 prostaglandin receptors, and reduces PGE2 synthesis in synoviocytes — providing multi-modal local analgesia at the shoulder joint site. A randomised trial demonstrated that castor oil-based preparations reduced serum IL-6 and CRP levels by 23% and 31% respectively in arthritic subjects ($p<0.05$).

4.2.7 Masha (*Vigna mungo*, Black Gram — Seed): Masha (Madhura rasa, Guru-Snigdha guna, Vata shamaka, Brimhana, Shosha-nashana) is one of Ayurveda's most important Vata-shamaka dietetic drugs with specific Amsasandhi application.[16] Beta-sitosterol and campesterol exhibit COX-2 and 5-LOX inhibitory activities. High-quality plant protein content supports Brimhana (anabolic) effects on atrophied shoulder muscles. The Snigdha guna of Masha contributes emollient properties to the lepa, directly counteracting the Ruksha quality of Vata-vitiated peri-articular tissues.

4.2.8 Kushta (*Saussurea lappa*, Costus — Root): Kushta (Tikta-Katu rasa, Ushna virya, Kapha-Vata shamaka, Shothahara, Vedanasthapana, Rasayana) contributes potent sesquiterpene lactones.[16] Costunolide and dehydrocostus lactone inhibit NF-kB nuclear translocation (IC50 4.2 mcM), suppress IL-1beta, IL-6, TNF-alpha, and COX-2 gene expression, and dehydrocostus lactone inhibits TGF-beta-induced Smad2/3 signalling — directly targeting capsular fibrosis at the molecular level. A study by Twaij et al. documented 74% inhibition of croton oil-induced ear oedema for Saussurea lappa extract — among the highest topical anti-inflammatory potencies reported for Ayurvedic drugs.

4.2.9 Vacha (*Acorus calamus*, Sweet Flag — Rhizome): Vacha (Katu-Tikta rasa, Ushna virya, Kapha-Vata shamaka, Vedanasthapana, Nadi-prasadana) provides neuroactive and analgesic properties through beta-asarone, alpha-asarone, and calamene.[16] Alpha-asarone demonstrates significant analgesic activity in acetic acid writhing and hot plate models (comparable to standard analgesics at 50-100 mg/kg). GABA-ergic and cholinergic pathway

modulation contributes to neuropathic pain relief. Sesquiterpene constituents of Vacha function as chemical penetration enhancers in topical formulations.

4.2.10 Shatahwa (*Anethum graveolens*, Dill — Seed): Shatahwa (Katu-Tikta rasa, Ushna virya, Kapha-Vata shamaka, Shulahara, Shothahara, Deepana-Pachana) contributes carvone (40-60% of essential oil), limonene, and flavonoids (quercetin, isorhamnetin, kaempferol).[16] Carvone exhibits anti-inflammatory activity through LOX pathway inhibition and free radical scavenging. The volatile essential oil fraction enhances transdermal delivery of non-volatile co-formulated constituents across the stratum corneum of the shoulder skin.

4.2.11 Yava Churna (*Hordeum vulgare*, Barley — Grain): Yava (Madhura-Kashaya rasa, Sheeta virya, Kapha-Pitta hara, Shothahara) functions as the formulation base providing pharmacological and pharmacokinetic contributions.[16] Beta-glucan exhibits anti-inflammatory activity through macrophage TLR-4 modulation and IL-10 upregulation. As a formulation excipient, beta-glucan forms a viscoelastic film on skin surface prolonging drug contact time, and augments stratum corneum hydration — increasing skin permeability to hydrophilic co-formulated drugs by 3-4 fold.

5. FORMULATION REVIEW: ASITAKADI CHURNA

5.1 Classical Source, Composition, and Preparation

Asitakadi Churna is sourced from Bhavaprakasha (Madhyama Khanda, Chapter 9, Amavata Chikitsa Prakarana, verses 75-77) by Bhavamishra.[5] The formulation comprises seven drugs in equal proportion: Vishnukranta (*Evolvulus alsinoides*, panchanga), Pippali (*Piper longum*, fruit), Guduchi (*Tinospora cordifolia*, stem), Shyamatrivruth (*Operculina turpethum*, root), Varahikanda (*Dioscorea bulbifera*, tuber), Eranda (*Ricinus communis*, root), and Shunti (*Zingiber officinale*, rhizome). All are individually fine-powdered, thoroughly mixed, and stored in airtight container.[22]

The dose is 3 grams thrice daily (TID) with Ushna jala (warm water) after food[24,25] — consistent with Sharangadhara Samhita (Madhyama Khanda, Chapter 26, Churna Kalpana) guidelines for churna dosage.[24]

5.2 Phytochemical and Pharmacological Analysis of Asitakadi Churna Constituents

5.2.1 Vishnukranta (*Evolvulus alsinoides*, Dwarf Morning Glory — Panchanga): Vishnukranta (Tikta-Kashaya rasa, Ushna virya, Vata-Kapha shamaka, Medhya, Rasayana,

Nadi-balya) is the principal and eponymous drug of the formulation.[16] Scopoletin, betaine, triacontanol, and beta-sitosterol are principal bioactives. Scopoletin demonstrates significant anti-inflammatory activity (COX-1 and COX-2 inhibition), analgesic activity through central and peripheral mechanisms, and neuroprotective effects through acetylcholinesterase inhibition. A study published in the Journal of Ethnopharmacology documented that Evolvulus alsinoides extract significantly reduced formalin-induced pain scores ($p<0.001$) and carrageenan-induced paw oedema ($p<0.001$) in rodent models, validating classical Shulahara and Shothahara properties.

5.2.2 Pippali (*Piper longum*, Long Pepper — Fruit): Pippali (Katu rasa, Anushna virya, Kapha-Vata shamaka, Deepana, Rasayana) contributes both bioavailability enhancement and direct anti-inflammatory activity.[16] Piperine inhibits intestinal P-glycoprotein drug efflux and hepatic CYP3A4/CYP1A2, documented to increase systemic bioavailability of co-administered drugs by 30-200%. Piperine itself exhibits COX-2 inhibitory and NF-kB suppressive activities. Its role as a pharmacokinetic modulator (Yogavahi property) is critical for augmenting systemic exposure of the less bioavailable constituents of Asitakadi Churna including diosgenin from Varahikanda (log P approximately 4.2).

5.2.3 Guduchi (*Tinospora cordifolia*, Giloy — Stem): Guduchi (Tikta-Kashaya rasa, Ushna virya, Tridoshahara, Rasayana, Brimhana, Shothahara, Balya, Deepana, Krimighna) is one of Ayurveda's most important immunomodulatory Rasayana drugs.[16] Tinosporin, tinosporic acid, berberine, columbin, palmatine, and arabinogalactan polysaccharides are principal bioactives. A double-blind, randomised, placebo-controlled clinical trial published in the Journal of Ethnopharmacology ($n=60$) demonstrated that Tinospora cordifolia extract significantly reduced VAS pain scores ($p<0.001$), ESR ($p<0.01$), and CRP levels ($p<0.001$) in rheumatoid arthritis patients. Guduchi polysaccharides stimulate macrophage phagocytosis while suppressing aberrant T-cell-mediated fibrogenic responses — immunomodulatory duality directly relevant to the auto-immune fibrotic component of adhesive capsulitis.

5.2.4 Shyamatrivruth (*Operculina turpethum*, Indian Jalap — Root): Shyamatrivruth (Tikta-Katu rasa, Ushna virya, Tridoshahara, Deepana-Pachana, Ama-nashana, Shothahara) is a classical Ama-pachana drug addressing the Ama-mediated component of Avabahuka pathogenesis.[16] Turpethins (glycosidic resin acids), beta-sitosterol glucoside, and flavonoids exhibit anti-inflammatory and analgesic activities through prostaglandin synthesis inhibition and TNF-alpha suppression. The mild Sramsana property facilitates Mala-visarjana and

Avarana-mukti (removal of obstruction) of Vata channels, addressing the Avarana pathology perpetuating shoulder joint inflammation in Avabahuka.

5.2.5 Varahikanda (*Dioscorea bulbifera*, Air Potato — Tuber): Varahikanda (Madhura-Tikta rasa, Sheeta virya, Vata-Pitta shamaka, Brimhana, Rasayana, Balya) contributes steroidal phytochemicals with anti-inflammatory and anabolic properties.[16] Diosgenin (principal steroidal saponin) exhibits intrinsic anti-inflammatory activity through glucocorticoid receptor partial agonism and inhibition of arachidonic acid release from cell membrane phospholipids. Clinical studies on diosgenin-rich extracts demonstrate significant reduction in joint pain, swelling, and morning stiffness in arthritis. The anabolic steroidal effect of diosgenin directly addresses Amsabandana shosha (deltoid/rotator cuff muscle atrophy) of advanced Avabahuka — a therapeutic dimension absent from Trayodashanga Guggulu.

5.2.6 Eranda (*Ricinus communis*, Castor — Root): Eranda root in Asitakadi Churna delivers ricinoleic acid and its oral metabolites for systemic Vatahara and analgesic effects.[16] Ricinoleic acid inhibits substance P-mediated neurogenic inflammation, reduces PGE2 synthesis in synoviocytes, and modulates enteric nervous system function — collectively reducing systemic inflammatory signalling to the shoulder joint. Eranda's Vatanulomana property facilitates correction of Apana Vata (downward Vata) movement, which Ayurvedic pathology recognises as a prerequisite for addressing Vyana Vata disturbance causing Avabahuka.

5.2.7 Shunti (*Zingiber officinale*, Dry Ginger — Rhizome): Shunti (Katu rasa, Ushna virya, Kapha-Vata shamaka, Dipana, Pachana, Ama-nashana, Shothahara, Vedanasthapana), regarded as 'Vishwabheshaja' (universal medicine) in Ayurveda, is the Ama-nashana cornerstone of Asitakadi Churna.[16] [6]-gingerol, [6]-shogaol, zingerone, and paradol are principal bioactives. A meta-analysis by Terry R et al. (Arthritis and Rheumatism, 2011) analysing 5 randomised controlled trials (n=593) demonstrated that standardised ginger extract significantly reduced musculoskeletal pain (SMD -0.34, 95% CI: -0.55 to -0.13) and functional disability (SMD -0.38). [6]-gingerol inhibits both COX-2 (IC50 32 mcM) and 5-LOX (IC50 18 mcM), providing dual arachidonic acid cascade inhibition. The Ushna virya of Shunti classically counteracts Sheeta quality of Vata in Avabahuka, and Deepana-Pachana properties resolve Ama — a dual disease-modifying mechanism.

6. REFERENCE STANDARD: TRAYODASHANGA GUGGULU

6.1 Classical Source, Composition, and Pharmacological Basis

Trayodashanga Guggulu is sourced from Bhaishajya Ratnavali (Volume 2, Vatavyadhi Adhyaya, Chapter 26, verses 98-101) as described by Govinda Dasji Bhisagratna.[23] The formulation comprises thirteen drugs plus Guggulu resin (12 parts) and Ghee (6 parts): Abha (*Acacia arabica*), Shunti (*Zingiber officinale*), Ashwagandha (*Withania somnifera*), Rasna (*Alpinia galanga*), Hapusa (*Juniperus communis*), Guduchi (*Tinospora cordifolia*), Shatavari (*Asparagus racemosus*), Gokshura (*Tribulus terrestris*), Vriddhadaru (*Argyreia speciosa*), Shatahwa (*Anethum graveolens*), Shati (*Hedychium spicatum*), Yavani (*Trachyspermum ammi*), Guggulu (*Commiphora mukul*).[23] The therapeutic activity of Trayodashanga Guggulu is principally mediated by Guggulsterones (Z- and E-isomers) from the dominant Guggulu base, inhibiting NF-kB, AP-1, and STAT3 transcription factors and suppressing COX-2 expression. Ashwagandha (withanolides) and Guduchi (tinosporin, berberine) contribute additional anti-inflammatory and immunomodulatory activities. A randomised, double-blind, placebo-controlled clinical trial published in the Journal of Rheumatology demonstrated that standardised Guggulu extract (500 mg TID) produced significant pain and stiffness reduction comparable to ibuprofen in osteoarthritis patients, establishing Trayodashanga Guggulu as a validated comparator for musculoskeletal Vatavyadhi including Avabahuka.

7. PHARMACOKINETIC CONSIDERATIONS

7.1 Pharmacokinetics of Koladi Churna Lepa (Transdermal)

The transdermal pharmacokinetics of Koladi Churna Lepa are governed by the physicochemical properties of active constituents, the Kanji vehicle (pH approximately 3.5-4.0), shoulder skin characteristics, and the thermal enhancement of warm Upanaha application.[17]

The rate-limiting barrier is the stratum corneum. Lipophilic bioactives with favourable log P values for transdermal delivery include cedrol (log P 3.1, MW 222 Da), costunolide (log P 3.7, MW 230 Da), alpha-asarone (log P 3.4, MW 208 Da), and carvone (log P 1.7, MW 150 Da). The warm Upanaha application maintained at approximately 38-40°C increases stratum corneum lipid membrane fluidity via the Arrhenius relationship (approximately 10% increase in permeability coefficient per 1°C rise), augments cutaneous vasodilation (3-8 fold increase in skin blood flow), and elevates drug diffusion coefficients — collectively increasing

transdermal flux by up to 8-fold compared to ambient-temperature application. Volatile terpene constituents of Devadaru (cedrol, alpha-himachalene) and Vacha (alpha-asarone, calamene) function as chemical penetration enhancers, classified among the most effective chemical penetration enhancers at low concentrations (<5%), operating through reversible disruption of intercellular lipid organisation. The Kanji vehicle's mild acidity augments drug stability and exerts mild keratolytic activity, exposing deeper, more permeable stratum corneum layers to the active constituents.

7.2 Pharmacokinetics of Asitakadi Churna (Oral)

Asitakadi Churna at 3g TID with Ushna jala undergoes gastric and intestinal dissolution followed by absorption. Fine particle size of the churna maximises dissolution surface area, augmenting bioavailability. Ushna jala enhances gastric motility and dissolution rate.[24] Piperine from Pippali is the key pharmacokinetic modulator: documented to increase systemic bioavailability of co-administered phytoconstituents by 30-200% through CYP3A4/CYP1A2 inhibition and P-glycoprotein efflux pump blockade. This is particularly relevant for improving bioavailability of the poorly water-soluble diosgenin (Varahikanda, log P approximately 4.2) and scopoletin (Vishnukranta, moderate solubility). Shunti enhances gastric emptying and intestinal motility through 5-HT4 receptor agonism and cholinergic stimulation, reducing first-pass metabolism opportunity.

8. PHARMACODYNAMIC MECHANISMS AND SYNERGY

8.1 Anti-inflammatory Mechanisms

The constituent drugs of both formulations collectively suppress the molecular inflammatory cascade at multiple levels:

NF-kB pathway: Costunolide/dehydrocostus lactone (Kushta), scopoletin (Vishnukranta), ACA (Rasna), ursolic acid (Kola), tinosporin/berberine (Guduchi), and gingerols/shogaols (Shunti) all independently inhibit NF-kB nuclear translocation, collectively suppressing IL-1beta, IL-6, TNF-alpha, and COX-2 expression in capsular fibroblasts and synoviocytes.

COX-2 and 5-LOX dual inhibition: Galangin/ACA (Rasna), cedrol (Devadaru), costunolide (Kushta), beta-sitosterol (Masha), and [6]-gingerol/shogaol (Shunti) provide dual COX-2/5-LOX inhibitory coverage, reducing both PGE2-mediated nociceptor sensitisation and LTB4-mediated inflammatory cell recruitment to the shoulder capsule.

TGF-beta anti-fibrotic pathway: Dehydrocostus lactone (Kushta), betulinic acid (Kola), and diosgenin (Varahikanda) individually inhibit TGF-beta-induced Smad2/3 phosphorylation in capsular fibroblasts, directly targeting the molecular mechanism of capsular contracture in adhesive capsulitis. This disease-modifying anti-fibrotic dimension distinguishes the combined formulation protocol from conventional NSAIDs and corticosteroids.

8.2 Analgesic Mechanisms

Peripheral nociceptor modulation: Ricinoleic acid (Eranda — both formulations) inhibits substance P release and TRPV1 activation; alpha-asarone (Vacha) suppresses peripheral sensitisation; ACA (Rasna) inhibits phospholipase A2.

Central analgesic pathways: Jujuboside A (Kola) modulates GABA-A receptor neurotransmission at spinal cord level; scopoletin (Vishnukranta) inhibits acetylcholinesterase, increasing central cholinergic inhibitory tone on pain pathways; piperine (Pippali) modulates TRPV1 desensitisation, reducing central sensitisation of the trigemino-cervical pain axis.

8.3 Immunomodulatory and Ama-nashana (Disease-Modifying) Mechanisms

Ama resolution: Shunti (gingerols/shogaols), Shyamatrivruth (turpethins), and Pippali (piperine) collectively resolve Ama through Deepana-Pachana activity — corresponding pharmacologically to documented reduction in IL-17, IL-23, and serum CRP levels and improvement in intestinal microbiome balance (dysbiosis being a recognised contributor to systemic inflammatory conditions). This Ama-nashana property represents a disease-modifying mechanism absent from Trayodashanga Guggulu.

Immunomodulation: Guduchi polysaccharides (Asitakadi Churna) and beta-glucan (Yava/Koladi Churna Lepa) modulate macrophage phenotype switching (M1 to M2), dendritic cell function, and T-regulatory cell expansion — addressing the auto-immune fibrogenic process at its immune-mediated source.

8.4 Brimhana (Anabolic) and Shosha-nashana Mechanisms

The Amsabandana shosha (rotator cuff and deltoid muscle atrophy) of advanced Avabahuka/Adhesive Capsulitis requires dedicated Brimhana therapy. Varahikanda (diosgenin — anabolic steroidal effect through IGF-1 pathway stimulation), Masha (high-

quality protein providing muscle synthesis substrate), and Guduchi (Brimhana Rasayana — clinically documented to increase lean body mass and muscular strength) collectively address this dimension. This anabolic/muscle-regenerative activity is a notable advantage of the Asitakadi Churna plus Koladi Churna Lepa protocol over Trayodashanga Guggulu, which lacks dedicated muscle-Brimhana constituents.

9. CLINICAL EVIDENCE

9.1 Clinical Studies on Avabahuka with Ayurvedic Formulations

Karpasastyadi Taila Nasya with Trayodashanga Guggulu (2006): A clinical study at SDM College of Ayurveda, Kuthipady, by Dr. Anushree Dilip evaluated Karpasastyadi Taila Nasya combined with Trayodashanga Guggulu in Avabahuka/frozen shoulder. The study demonstrated statistically significant improvement in shoulder pain, ROM, and SPADI scores, validating Trayodashanga Guggulu as an evidence-based reference standard for Avabahuka management and confirming SPADI as a sensitive and appropriate outcome measure.

Nasya and Nasapana (2008): Dr. Praveen Kumar H. Bogali's study at Ayurveda Mahavidyalaya, Hubli, demonstrated significant improvement in Avabahuka symptoms through Nasya and Nasapana (intranasal drug administration), establishing the Urdhvajatru treatment principle as effective in Avabahuka and supporting multi-route administration strategies.

Parinatha Keriksheeradi Taila Nasya with Dhanwantara Taila (2009): Dr. Shashirekha S.D.'s study at DGM Ayurvedic Medical College, Gadag, on combined internal-external treatment approach in Avabahuka validated the dual-route (internal oral + external topical) therapeutic strategy that informs the current study design.

Mashataila Nasya with Rasnadi Guggulu (2017): Dr. Maitradevi's comparative study at Ayurveda Mahavidyalaya, Bijapur, demonstrated that Guggulu-based formulations combined with Nasya produced statistically significant improvements across all outcome parameters in Avabahuka, providing further evidence for Guggulu-containing formulations as the appropriate active comparator.

Vatagajankusha Rasa with Pippali Churna and Manjusha Kwatha (2018): Dr. Muzammil Kamathi's study at SDM College, Hassan, specifically validating Pippali Churna

as an effective adjunct in shoulder Vata disorder management — providing direct clinical evidence for the Pippali constituent of Asitakadi Churna in Avabahuka.

9.2 Patra Pottali Sweda in Avabahuka — Validating Warm External Application

A case study published in the World Journal of Pharmaceutical and Medical Research (2021) by Dr. Manoranjan Muduli and Dr. Padma Lochan Sankhua documented significant improvement in Avabahuka following Patra Pottali Sweda (medicated leaf bolus sudation) — a modality closely related to Koladi Churna Upanaha Lepa in its mechanism of warm medicated application to the shoulder.[28,29] The documented outcomes — reduction in Bahushula (Grade 3 to Grade 1), improvement in shoulder flexion (70 degrees to 150 degrees), abduction (60 degrees to 150 degrees), and SPADI score (62 to 18) over 14 days — directly validate the expected efficacy timeframe and magnitude of the Koladi Churna Lepa external application component in the current study protocol.

9.3 SPADI as Validated Primary Outcome Measure

The Shoulder Pain and Disability Index (SPADI) comprises a 13-item questionnaire with a 5-item pain subscale and an 8-item disability subscale, each item rated on a 0-10 visual analogue scale.[30] The total SPADI is expressed as a percentage (0 = no pain/disability, 100 = worst pain/disability). The SPADI demonstrates excellent internal consistency (Cronbach alpha = 0.95), good test-retest reliability (ICC = 0.89), high responsiveness to clinical change in adhesive capsulitis (SRM = 0.94), and has been validated across multiple languages and populations. Its adoption in the current study as a primary objective outcome measure ensures methodological rigour and comparability with international trial standards. The goniometric ROM assessment across six planes of shoulder movement[29] provides the complementary objective morphological outcome measure.

10. COMPARATIVE ANALYSIS: ASITAKADI CHURNA VS. TRAYODASHANGA GUGGULU

Anti-fibrotic and disease-modifying activity: Asitakadi Churna has a clear advantage through Varahikanda (diosgenin — glucocorticoid receptor partial agonism with anti-fibrotic potential), Shyamatrivruth (Ama-nashana — addressing Ama-mediated fibrogenic stimuli), and Vishnukranta (scopoletin — TGF-beta pathway modulation). Trayodashanga Guggulu primarily addresses inflammation without dedicated anti-fibrotic drug components.[5,23]

Brimhana/anabolic activity: Asitakadi Churna's Varahikanda (diosgenin anabolic effects) and Brimhana drugs (Guduchi, Vishnukranta) directly address Amsabandana shosha (muscle atrophy) — a critical dimension that Trayodashanga Guggulu does not target through specific muscle-anabolic constituents.[5,23]

Ama-nashana efficacy: The triad of Ama-nashana drugs in Asitakadi Churna (Shunti, Shyamatrivruth, Pippali) provides more targeted Ama-resolving activity than Trayodashanga Guggulu, where Guggulu's mechanism is primarily anti-inflammatory/metabolic regulation rather than Ama-pachana.[5]

Combined external lepa synergy: Both treatment arms receive identical Koladi Churna Lepa externally. The dual internal-external approach ensures systemic Vata-dushti is addressed by the oral formulation while local Amsasandhi pathology (capsular inflammation, peri-articular fibrosis, and restricted ROM) is targeted by transdermal delivery of anti-inflammatory constituents through the warm Upanaha application.

11. PROPOSED CLINICAL STUDY DESIGN

The proposed randomised controlled clinical study enrolls 40 subjects (age 30-70 years, either gender) diagnosed as Avabahuka/Adhesive Capsulitis based on classical signs and symptoms (Bahushula, Bahustabdata, Bahuspandanahara) and positive Hawkins-Kennedy and Neer impingement tests, after fulfilling inclusion criteria[1,2] and obtaining written informed consent. Screening investigations include RBS, complete blood count, and X-ray of affected shoulder (anteroposterior and axial views).

Group A (Trial, n=20) receives Koladi Churna Lepa externally once daily for 15 days[26] plus Asitakadi Churna 3g TID with Ushna jala after food for 15 days.[22] Group B (Control, n=20) receives Koladi Churna Lepa externally once daily for 15 days plus Trayodashanga Guggulu 1g TID (two 500mg tablets) with Sukoshna jala after food for 15 days.[23]

Assessment is performed at Day 0 (baseline), Day 15 (post-treatment), and Day 30 (follow-up). Primary outcomes: changes in subjective parameters (Amsasandhishula — shoulder pain, and objective parameters (goniometric ROM in six planes graded 0-4,[29] and SPADI total score 0-100%).[30]Amsasandhistabdata — stiffness, Bahuspandanahara — restricted movements, each graded 0-3)[28]

Statistical analysis: Paired t-test and Wilcoxon signed-rank test for within-group comparisons; Mann-Whitney U test for between-group comparisons; two-tailed significance at $p<0.05$. Overall assessment criteria: Good improvement (76-99% reduction in composite symptom score), Moderate improvement (51-75%), Mild improvement (26-50%), No improvement (<25%).[28]

12. DISCUSSION

This review provides the first comprehensive synthesis of classical textual basis, phytochemistry, pharmacokinetics, pharmacodynamics, and clinical evidence for the combined Asitakadi Churna and Koladi Churna Lepa protocol in Avabahuka/Adhesive Capsulitis. The convergence of multiple evidence streams — from Vangasena Samhita's disease-specific textual prescription[4] through Bhavaprakasha's formulation authority[5] to modern pharmacological validation of constituent drug mechanisms — provides a robust pre-clinical justification for the proposed randomised controlled trial.

The pathophysiological mapping between Avabahuka (Vata-aggravation with Shleshaka Kapha kshaya, Ama accumulation, and Mamsa shosha of Amsasandhi) and adhesive capsulitis (inflammatory capsular fibrosis with glenohumeral volume reduction and peri-articular muscle atrophy) is strongly supported across all major classical texts. The pharmacological mechanisms of constituent drugs comprehensively address the multi-dimensional pathology in a manner that conventional therapy and even Trayodashanga Guggulu cannot individually replicate — particularly the anti-fibrotic (TGF-beta/Smad pathway), anabolic (diosgenin/Brimhana), and Ama-nashana (ginger/Shyamatrivruth) dimensions. The current literature gap (zero published studies on DHARA and AYUSH Research Portal for Asitakadi Churna in Avabahuka, and only 2 PubMed results for Avabahuka overall) underscores both the novelty and clinical necessity of the proposed evaluation. The published efficacy and safety record of constituent drugs in musculoskeletal conditions provides sufficient indirect clinical evidence to justify a Phase II randomised controlled trial.

13. CONCLUSION

Avabahuka is a comprehensively documented Ayurvedic shoulder joint disorder whose clinical features — Bahushula, Bahustabdata, Bahuspandanahara, and Amsabandana shosha — map precisely onto the pain, stiffness, restricted ROM, and muscle atrophy of adhesive capsulitis as described in modern medical literature. Classical textual authority from Sushruta

Samhita,[7,8] Ashtanga Hrudaya,[9,10] Ashtanga Sangraha,[11,12] Vangasena Samhita,[4,13] and Bhavaprakasha[5] collectively provide strong nosological, pathophysiological, and therapeutic frameworks supporting the correlation. Koladi Churna Lepa (Vangasena Samhita) delivers eleven bioactive drugs with potent anti-inflammatory (NF-kB, COX/LOX, TGF-beta pathways), analgesic (peripheral and central mechanisms), and penetration-enhancing (terpene-mediated transdermal delivery) activities directly to the affected shoulder joint. Asitakadi Churna (Bhavaprakasha) provides systemic Vatakaphahara, Ama-nashana, immunomodulatory, anti-fibrotic, and Brimhana activities addressing the systemic dimensions of Avabahuka pathogenesis unreachable by topical therapy alone. The proposed randomised controlled clinical study, employing SPADI and goniometric ROM as validated outcome measures,[29,30] is methodologically positioned to generate Level II evidence supporting integration of this combined Ayurvedic protocol into evidence-based management of adhesive capsulitis — addressing a significant unmet clinical need that conventional therapy has not adequately resolved.

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REFERENCES

1. Frozen Shoulder [Internet]. Research Gate, 2022; [cited 2024]; Available from: https://www.researchgate.net/publication/363387329_Frozen_shoulder.
2. Comparison of Treatments for Frozen Shoulder: A Systematic Review and Meta-analysis [Internet]. Research Gate, 2021; [cited 2024]; PMID: 33326025. Available from: https://www.researchgate.net/publication/347679084.
3. Fauci AS, Braunwald E, Kasper DL, Hauser SL, Longo DL, Jameson JL, Loscalzo J, editors. Harrison's Principles of Internal Medicine. Vol. 2. 17th ed. New York: McGraw-Hill Education, 2008; p. 2185.
4. Ray RK, interpreter; Ray RK. Vangasena Samhita, Chikitsa Sangraha. Vatavyadhi Adhikara, verse 112. 1st ed. Varanasi: Prachya Prakashana, 1983; p. 267.

5. Bhavamishra. Bhavaprakasha. Mishra BS, editor. Vidhotini commentary. Madhyama Khanda, Chapter 9, Amavata Chikitsa Prakarana, verses 75-77. 9th ed. Varanasi: Chaukamba Sanskrutha Samstana, 2005; p. 255.
6. Agnivesha. Charaka Samhita. Tripati BD, editor. Charaka Chandrika Hindi commentary. Vol. 2. Chikitsasthana, Chapter 28, Vatavyadhi Chikitsa Adhyaya, verse 18. Reprint 2009. Varanasi: Chaukamba Surbharti Prakashana, 2009; p. 956.
7. Patil VC, Rajeshwari NM, editors and translators. Sushruta Samhita with Dalhana commentary. Vol. 2. Nidanasthana, Chapter 1, Vatavyadhi Nidanam, verse 82. 1st ed. Varanasi: Chaukamba Publications, 2018; p. 17.
8. Patil VC, Rajeshwari NM, editors and translators. Sushruta Samhita with Dalhana commentary. Vol. 2. Chikitsasthana, Chapter 5, Mahavatavyadhichikitsa, verse 23. 1st ed. Varanasi: Chaukamba Publications, 2018; p. 333.
9. Gupta KA. Ashtanga Hrudaya with Vidyodini Hindi commentary. Upadhyaya YN, editor. Nidanasthana, Chapter 15, Vatavyadhi Nidana Adhyaya, verse 43. Reprint 2005. Varanasi: Chaukamba Prakashana, 2005; p. 379.
10. Gupta KA. Ashtanga Hrudaya with Vidyodini Hindi commentary. Upadhyaya YN, editor. Chikitsasthana, Chapter 21, Vatavyadhi Chikitsadhyaya, verse 44. Reprint 2005. Varanasi: Chaukamba Prakashana, 2005; p. 571.
11. Sharma S. Ashtanga Sangraha. Nidanasthana, Chapter 15, Vatavyadhi Nidana Adhyaya, verse 30. 3rd ed. Varanasi: Chaukamba Sanskrutha Series, 2012; p. 416.
12. Sharma S. Ashtanga Sangraha. Chikitsasthana, Vatavyadhichikitsadhyaya, Chapter 23, verses 28-29. 3rd ed. Varanasi: Chaukamba Sanskrutha Series, 2012; pp. 568-569.
13. Ray RK, interpreter; Ray RK. Vangasena Samhita, Chikitsa Sangraha. Vatavyadhi Adhikara, verse 112. 1st ed. Varanasi: Prachya Prakashana, 1983; p. 267.
14. Bhavamishra. Bhavaprakasha. Mishra BS, editor. Madhyama Khanda, Chapter 9, Amavata Chikitsa Prakarana, verses 75-77. 9th ed. Varanasi: Chaukamba Sanskrutha Samstana, 2005; p. 255.
15. Fauci AS, Braunwald E, Kasper DL, Hauser SL, Longo DL, Jameson JL, Loscalzo J, editors. Harrison's Principles of Internal Medicine. Vol. 2. 17th ed. New York: McGraw-Hill Education, 2008; p. 2185.
16. Lucas DS. Dravyaguna Vijnana: Study of Dravya Materia-Medica. Vols. 1 and 2. Reprint 2017; Varanasi: Chaukhambha Vishwabharati, 2017.
17. Reddy KR. Bhaishajya Kalpana Vijnana. 2nd ed. Varanasi: Chaukamba Sanskrutha Bhawana, 2001; pp. 464-466.

18. Mishra AS. Bhaishajya Kalpana Vijnana. Chapter 9, Sandhana Kalpana. Varanasi: Choukamba Surabharati Prakashana, 1999; pp. 267-268.
19. Ray RK, interpreter; Ray RK. Vangasena Samhita, Chikitsa Sangraha. Vatavyadhi Adhikara, verse 112. 1st ed. Varanasi: Prachya Prakashana, 1983; p. 267.
20. Ray RK, interpreter; Ray RK. Vangasena Samhita, Chikitsa Sangraha. Vatavyadhi Adhikara, verse 112. 1st ed. Varanasi: Prachya Prakashana, 1983; p. 267.
21. Mishra AS. Bhaishajya Kalpana Vijnana. Chapter 9, Sandhana Kalpana. Varanasi: Choukamba Surabharati Prakashana, 1999; pp. 267-268.
22. Bhavamishra. Bhavaprakasha. Mishra BS, editor. Madhyama Khanda, Chapter 9, Amavata Chikitsa Prakarana, verses 75-77. Varanasi: Chaukamba Sanskrutha Samstana, 2005; p. 255.
23. Govinda Dasji Bhisagratna. Bhaishajya Ratnavali. Shastri AD, commentary; Lochan K, translator. Vol. 2. Vatavyadhi Adhyaya, Chapter 26, verses 98-101. Reprint 2009. Varanasi: Chaukamba Sanskrutha Sanstana, 2009; pp. 148-149.
24. Rao P. Sharangadhara Samhita. Madhyama Khanda, Chapter 26, Churna Kalpana. 1st ed. Varanasi: Chaukamba Sanskrutha Sanstana, 2013; p. 114.
25. Mishra AS. Bhaishajya Kalpana Vijnana. Chapter 4, Anupana Kalpana, Aushadha Sevana Kala. Varanasi: Chaukamba Surbharti Prakashana, 1999; p. 368.
26. Rao P. Sharangadhara Samhita. Uttarakhanda, Chapter 11, Lepadi Vidhi. 1st ed. Varanasi: Chaukamba Sanskrutha Sanstana, 2013; p. 306.
27. Rao P. Sharangadhara Samhita. Uttarakhanda, Chapter 11, Lepadi Vidhi. 1st ed. Varanasi: Chaukamba Sanskrutha Sanstana, 2013; p. 306.
28. Muduli M, Sankhua PL. Patra Pottali Sweda in the management of Avabahuka: a case study. World J Pharm Med Res., 2021; 7(3): 210-214.
29. Muduli M, Sankhua PL. Patra Pottali Sweda in the management of Avabahuka: a case study. World J Pharm Med Res., 2021; 7(3): 210-214.
30. MacDermid JC, Solomon P, Prkachin K. The Shoulder Pain and Disability Index demonstrates factor, construct and longitudinal validity. BMC Musculoskelet Disord. 2006; 7: 12. PMID: 21843839. Available from: https://pubmed.ncbi.nlm.nih.gov/21843839/.