RESEARCH PAPER

A Comparative Clinical Evaluation of *Dhatri-Khadira Kwath* with *Bhallataka-Snuhi Lepa* Versus *Dhatri-Khadira Kwath* with *Kakodumbradi Lepa* in the Management of *Shvitra* (Vitiligo): A Clinical Protocol and Pharmacological Review

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Abstract

Background: *Shvitra* (Vitiligo) is an acquired depigmentation dermatosis characterized by well-demarcated amelanotic macules resulting from the progressive destruction or inactivation of cutaneous melanocytes. In Ayurveda, *Shvitra* is classified under the umbrella of *Kushtha Roga* (dermatological disorders) and is pathophysiologically linked to the chronicity of *Dushivisha* (latent metabolic toxins) afflicting *Rakta*, *Mansa*, and *Meda Dhatus*.

Objectives: To formulate a comparative clinical protocol evaluating the efficacy and safety of *Dhatri-Khadira Kwath* combined with *Bhallataka-Snuhi Lepa* (Group 1) versus *Dhatri-Khadira Kwath* combined with *Kakodumbradi Lepa* (Group 2) in patients with *Shvitra*, and to elucidate the cellular and biochemical modes of action of these botanical formulations.

Materials and Methods: A randomized comparative clinical trial is designed involving 40 patients aged 16–60 years presenting with mild-to-moderate *Shvitra* (chronicity <10 years) recruited from the OPD/IPD of Government Ayurvedic College & Hospital, Patna. Group 1 receives oral *Dhatri-Khadira Kwath* (50 ml twice daily) and topical *Bhallataka-Snuhi Lepa*. Group 2 receives oral *Dhatri-Khadira Kwath* (50 ml twice daily) and topical *Kakodumbradi Lepa*. Clinical assessments are conducted at 15-day intervals over a 90-day trial period using surface area graph-metrics, lesion count, Wood's lamp examination, and pre- and post-treatment histopathological biopsies.

Pharmacological Rationale: The oral decoction (*Dhatri-Khadira Kwath*) exerts systemic anti-inflammatory, *Dushivishahara*, antioxidant, and blood-purifying actions. Topically, *Bhallataka-Snuhi Lepa* initiates localized vasodilation and mild chemical irritation to recruit amelanotic melanocyte precursors from follicular reservoirs, whereas *Kakodumbradi Lepa* delivers concentrated furocoumarins (*psoralens*) directly to activate tyrosinase-mediated melanogenesis upon solar exposure.

Keywords: *Shvitra*, Vitiligo, *Dushivisha*, *Bhallataka-Snuhi Lepa*, *Kakodumbradi Lepa*, *Dhatri-Khadira Kwath*, Melanogenesis, Psoralen.

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1. Introduction

Ayurveda approaches health and disease through a homeostatic equilibrium of *Doshas*, *Dhatus*, and *Malas*. *Agadtantra* (toxicology and forensic medicine) is one of the eight fundamental branches (*Ashtanga Ayurveda*), dedicated to understanding the etiology, clinical manifestations, and management of animate (*Jangama*), inanimate (*Sthavara*), and synthetic or cumulative poisons (*Kritrima* / *Gara* / *Dushivisha*).

Acharya Sushruta defines *Agadtantra* in *Sushruta Samhita*:

अगदतन्त्रं नाम सर्पकीटलूतामूषिकादिदष्टविषव्यञ्जनार्थं विविधविषसंयोगोपशमनार्थं च |

(सु. सू. १/१४)

(Agadtantra deals with the clinical signs, symptoms, and antidotal management of bites from snakes, insects, spiders, and rodents, as well as the mitigation of complex, cumulative toxic combinations).

In contemporary clinical terms, *Shvitra* corresponds closely with Vitiligo—a progressive, idiopathic hypopigmentation disorder characterized by the selective loss of functional melanocytes from the basal layer of the epidermis. Affecting approximately 1% of the global population, Vitiligo carries a substantial psychosocial stigma, leading to severe social impairment and reduced quality of life.

Contemporary dermatology identifies three primary pathogenic hypotheses for vitiligo:

1. **Autoimmune Hypothesis:** Cytotoxic CD8+ T-cell-mediated destruction of melanocytes.
2. **Neural Hypothesis:** Neurochemical mediators released from cutaneous nerve endings exerting localized melanocyte toxicity.
3. **Oxidative Stress / Biochemical Hypothesis:** Intracellular accumulation of reactive oxygen species (ROS) inducing melanocyte apoptosis and self-destruction.

In Ayurveda, the persistent accumulation of *Dushivisha* (low-potency, chronic, un-eliminated toxins) vitiates the humoral *Doshas*, impairs microcirculation (*Srotorodha*), and disrupts *Bhrajaka Pitta* (the cutaneous pigmentary metabolic sub-dosha), directly leading to the clinical emergence of *Shvitra*.

2. Classical Review of *Shvitra* (Disease Review)

2.1 Vedic Foundations

The historical documentation of hypopigmentation disorders dates back to the Vedic literature. The *Atharvaveda* employs the terms *Kilasa* and *Palita* to designate depigmentation conditions:

किलासं पलितं च यत् |

(अ. वे. १/२३/१)

The *Atharvaveda* traces the fundamental pathogenesis of *Kilasa* to *Dushi* (toxic corruption of tissues):

दूषयति शरीरमिति दूषिः |

(अ. वे. १/२३/४)

This establishes *Dushivisha* as a foundational causative element of *Shvitra* in classical medical philosophy.

2.2 Etiology (*Nidana*) and the Pathophysiology of *Dushivisha*

While Acharya Charaka states that all dermatoses (*Kushtha*) are *Tridoshaja* in nature, *Kilasa* (*Shvitra*) is distinguished by its primary manifestation as depigmentation without exudation or ulceration. In *Sushruta Samhita*, Acharya Sushruta notes that *Kilasa* is an offshoot of *Kushtha*:

किलासमपि कुष्ठविकल्प एव; तत्त्रिविधं वातेन, पित्तेन, श्लेष्मणा चेति |

(सु. नि. ५/१७)

The systemic vitiation caused by *Dushivisha*—exacerbated by adverse geographical habitat (*Desha*), seasonal shifts (*Kala*), unwholesome dietary habits (*Viruddha Ahara*), and daytime sleeping (*Divasvapna*)—provokes chronic cutaneous manifestations:

ततः करोत्यन्नमदाविपाकावरोचकं मण्डलकोठमोहान् ||

वैवर्ण्यमूर्च्छाविषमज्वरान् वा कुर्यात् प्रवृद्धां प्रबलां तृषां वा |

गाढ्यमन्यज्जनयेच्च कुष्ठं तांस्तान् विकारांश्च बहुप्रकारान् ||

(सु. क. २/३०-३२)

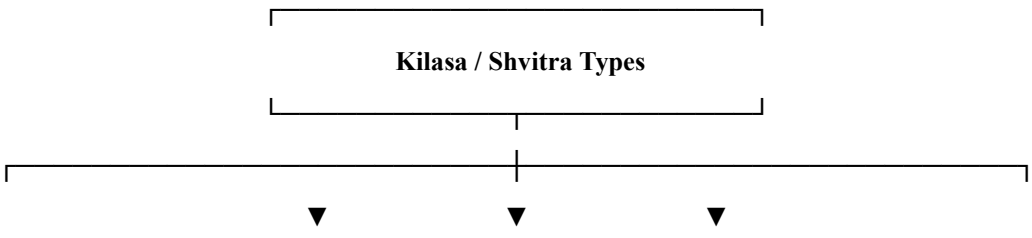
2.3 Classical Classification and Nomenclature

Acharya Charaka designates three clinical varieties of *Kilasa* based on morphological color transitions and doshic involvement:

दारुणं चारुणं श्वित्रं किलासं नामभिस्त्रिभिः |

विज्ञेयं त्रिविधं तच्च त्रिदोषं प्रायशश्च तत् ||

(च. चि. ७/१७३)



Daruna	*Charuna*	*Shvitra*
(Raktaja)	*(Mamsaja)*	*(Medaja)*

2.4 *Dhatu* Affliction, Color Differentiation, and Prognosis

The depth of tissue involvement (*Dhatu Gata Samprapti*) governs both the visual coloration and the clinical prognosis of the lesions:

दोषे रक्ताश्रिते रक्तं ताम्रं मांससमाश्रिते |

श्वेतं मेदःश्रिते श्वित्रं गुरु तच्चोत्तरोत्तरम् ||

(च. चि. ७/१७४)

- **Raktashrita:** Localized in the *Rakta Dhatu*; lesions present with a red (*Rakta Varna*) hue; highly responsive to therapy.
- **Mamsashrita:** Localized in the *Mamsa Dhatu*; lesions appear coppery or tawny (*Tamra Varna*); moderate prognosis.
- **Medashrita:** Deeply seated in the *Meda Dhatu*; lesions manifest as bright white (*Shweta Varna*); represents true *Shvitra* and is chronic and difficult to treat (*Guru / Krichhrasadhya*).

2.5 Clinical Features (*Lakshana*) by Doshic Dominance

Acharya Sushruta details the distinctive phenotypic presentations according to the predominant *Dosha*:

वातेन मण्डलमरुणं परुषं परिध्वंसि च, पित्तेन पद्मपत्रप्रतीकाशं सपरिदाहं च, श्लेष्मणा श्वेतं स्निग्धं बहलं कण्डूमच्च |

(सु. नि. ५/१७

Doshic Type	Features (Lakshana)	Classical Description
Vataja	Tawny/Reddish, rough, xerotic, scaling borders	*Mandalam arunam parusham paridhwamsi cha*
Pittaja	Lotus-petal pink/red, localized burning, rapid spread	*Padmapatra prateekasham saparidaham cha*
Kaphaja	Dense chalky-white, unctuous, thick, pruritic	*Shwetam snigdham bahalam kandoomat cha*

3. Pharmacological Review and Modes of Action

TRI-MODAL THERAPEUTIC REGIMEN

▼	▼	▼
ORAL DECOCTION	**TOPICAL GROUP 1**	**TOPICAL GROUP 2**
Dhatri-Khadira Kwath	*Bhallataka-Snuhi Lepa*	*Kakodumbradi Lepa*

3.1 *Dhatri-Khadira Kwath* (Systemic Formulation)

Prescribed in the *Sharangdhara Samhita*:

क्वाथोऽवलगुजचूर्णाढ्यो धात्रीखदिरसारयोः |

जयेत्सुशीलितो नित्यं श्वित्रं पथ्याशिनां नृणाम् ||

(शा. सं. म. खं. २/१३७)

Phytochemical and Pharmacodynamic Action

- **Khadira (*Acacia catechu* Bark):** Rich in catechin, epicatechin, and taxifolin. It serves as a potent *Raktashodhaka* (blood purifier) and *Kushthaghna*

agent, suppressing pro-inflammatory cascades (TNF-α, IL-6) that target melanocytes.

- **Dhatri / Amla (*Emblica officinalis* Fruit Pulp):** Concentrated in ascorbic acid, gallic acid, ellagic acid, and emblicanin. It provides powerful antioxidant support, neutralizes localized reactive oxygen species (ROS), counters *Dushivisha*, and normalizes *Bhrajaka Pitta.*

- **Bakuchi (*Psoralea corylifolia* Seed):** Contains bioactive furocoumarins including psoralen, isopsoralen, and the meroterpene bakuchiol. Systemic absorption allows psoralens to reach dermal capillary networks, photosensitizing epidermal target sites for UV-driven melanocyte recovery.

3.2 *Bhallataka-Snuhi Lepa* (Topical Formulation - Group 1)

रात्रौ गोमूत्रे वासितान् जर्जराङ्गा-

नहिनच्छायां शोषयेत् स्फोटहेतून् |

एवं वारांस्त्रीन् भावयेच्छ्लक्ष्णपिष्टैः

स्नुह्याः क्षीरेण श्वित्रनाशाय लेपः ||

(अ. सं. चि. २२/१३)

Phytochemical and Pharmacodynamic Action

- **Bhallataka (*Semecarpus anacardium* Fruit):** Classified under *Upavisha*, Bhallataka contains phenolic bio-actives such as bhilawanol, anacardic acid, and cardol. When applied topically after standard *Shodhana* (purification in Gomutra), it acts as a mild controlled counter-irritant. This irritant action induces sterile localized hyperemia and erythema, upregulating basic fibroblast growth factor (bFGF) and endothelin-1 (ET-1). These chemical signals activate dormant, unpigmented melanocyte stem cells situated within the outer root sheath (ORS) of adjacent hair follicles, stimulating their migration to the depigmented interfollicular epidermis.

- **Snuhi (*Euphorbia neriifolia* Latex/Ksheer):** Contains diterpene esters, euphorbon, and triterpenes. It exhibits potent *Teekshna* (sharp/penetrating) and keratolytic properties. By softening and desquamating the stratum corneum, it acts as a natural transdermal permeation enhancer, allowing the active principles of Bhallataka to reach the basal melanocyte layer directly.

3.3 *Kakodumbradi Lepa* (Topical Formulation - Group 2)

Described in *Charaka Samhita*:

काकोदुम्बरिका वा सावल्गुजचित्रका गवां मूत्रे |

(च. चि. ७/१७०)

Phytochemical and Pharmacodynamic Action

- **Bakuchi (*Psoralea corylifolia* Seed):** Direct topical application ensures saturation of the amelanotic patch with psoralen and isopsoralen. Upon concurrent solar or UV-A exposure, psoralen binds to pyrimidine bases in DNA, upregulating the gene transcription of the tyrosinase enzyme complex and stimulating rapid melanogenesis.

- **Kakodumbar (*Ficus hispida* Bark):** Rich in ficusin, hispidin, and bergapten. Classical literature recognizes Kakodumbar as *Shvitrahara* (anti-vitiligo), working synergistically with psoralens to facilitate dermal tissue repair and stimulate *Bhrajaka Pitta*.

- **Chitraka (*Plumbago zeylanica* Root):** Contains the bioactive naphthoquinone plumbagin. It provides localized *Deepana* and *Pachana* at the cellular level, stimulating dermal microcirculation and enhancing localized metabolic activity to support cellular repigmentation.

- **Gomutra (Cow's Urine Vehicle):** Serves as an alkaline bioenhancer (*Yogavahi*), facilitating transdermal delivery and promoting microvascular patency.

4. Materials and Methods

4.1 Study Setting and Ethics

The clinical study is designed to be executed within the Post Graduate Department of Agadtantra Avum Vidhi Vaidyaka, Government Ayurvedic College and Hospital (GACH), Patna, under Bihar University of Health Sciences (BUHS). Ethical clearance is obtained from the Institutional Ethics Committee (IEC) prior to patient registration. Written informed consent is mandatory for all registered participants.

4.2 Research Hypotheses

- **Null Hypothesis (H_0):** *Bhallataka-Snuhi Lepa* with *Dhatri-Khadira Kwath* shows no significant difference in clinical efficacy compared to *Kakodumbradi Lepa* with *Dhatri-Khadira Kwath* in the management of *Shvitra*.

- **Alternate Hypothesis (H_1):** *Bhallataka-Snuhi Lepa* with *Dhatri-Khadira Kwath* demonstrates superior clinical efficacy compared to *Kakodumbradi Lepa* with *Dhatri-Khadira Kwath* in the management of *Shvitra*.

4.3 Drug Profiles

Formulation	Sanskrit	Botanical Name	Family	Part Used

	Name			
Dhatri-Khadira Kwath	*Dhatri (Amla)*	*Emblica officinalis*	Phyllanthaceae	Fruit pulp
	Khadira	*Acacia catechu*	Mimosoideae	Heartwood Bark
	Bakuchi	*Psoralea corylifolia*	Fabaceae	Seeds
Bhallataka-Snuhi Lepa	*Bhallataka*	*Semecarpus anacardium*	Anacardiaceae	Fruit
	Snuhi	*Euphorbia neriifolia*	Euphorbiaceae	Ksheer (Latex)
Kakodumbradi Lepa	*Kakodumbar*	*Ficus hispida*	Moraceae	Bark
	Bakuchi	*Psoralea corylifolia*	Fabaceae	Seeds
	Chitraka	*Plumbago zeylanica*	Plumbaginaceae	Root (*Mool*)
	Gomutra	*Bos taurus indicus* filtrate	—	Fresh filtrate

4.4 Study Population and Criteria

Diagnostic Criteria

- Clinical presentation of well-defined depigmented/amelanotic patches distributed symmetrically or segmentally on the trunk, extremities, or face.
- Lesions demonstrate characteristic chalky-white or blue-white fluorescence under Wood's lamp examination.

Inclusion Criteria

1. Diagnosed cases of uncomplicated segmental or non-segmental vitiligo involving either sex.
2. Chronological age between 16 and 60 years.
3. Disease chronicity <10 years.
4. Confirmed Wood's lamp positive lesions.
5. Etiological confirmation of *Dushi* / *Gara Visha* exposure determined by a structured history questionnaire.
6. Baseline surface area and patch counts categorized within mild-to-moderate grades.

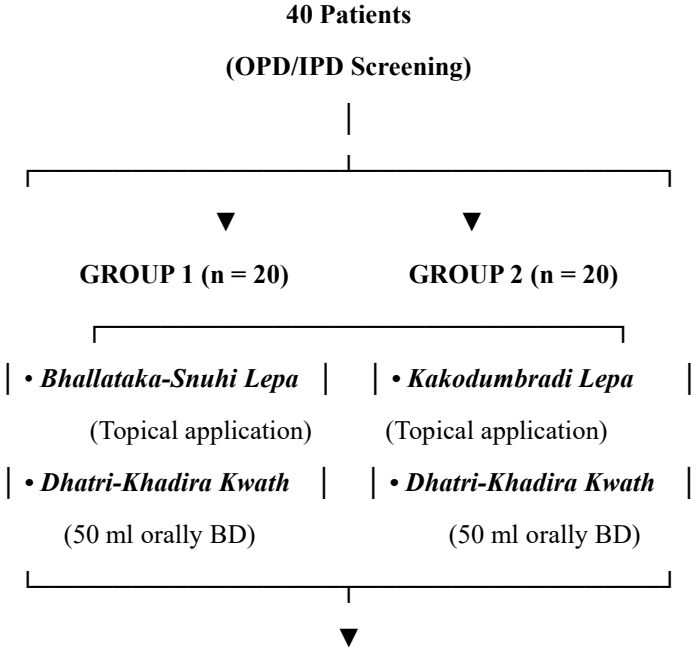
Exclusion Criteria

1. Disease chronicity exceeding 10 years.
2. Associated systemic comorbidities: hypothyroidism, severe anemia, diabetes mellitus, systemic hypertension, active pulmonary tuberculosis, rheumatoid arthritis, systemic lupus erythematosus (SLE).
3. Rapidly spreading, active vitiligo associated with severe localized erythema, blister formation, or intense itching.

4. Secondary leukoderma resulting from deep thermal burns, chemical exposure (deodorants, synthetic dyes, industrial chemicals).
5. Gravid and lactating females.
6. Lesions involving the mucosal or acral regions (*Guhyanga* / genitalia, *Pani-Padatala* / palms and soles, *Oshtha* / lips), or generalized universal vitiligo (*Ekanga* / *Sarvanga*).
7. Non-compliant or uncooperative patients.

4.5 Study Design and Grouping

A randomized, open-label, two-arm clinical study design is implemented:



- **Group 1 (N = 20):** Administered oral *Dhatri-Khadira Kwath* (50 ml, twice daily after food) along with topical application of *Bhallataka-Snuhi Lepa* over the patches, followed by controlled early-morning sun exposure (5–10 minutes).
- **Group 2 (N = 20):** Administered oral *Dhatri-Khadira Kwath* (50 ml, twice daily after food) along with topical application of *Kakodumbradi Lepa* over the patches, followed by controlled early-morning sun exposure (5–10 minutes).
- **Study Duration & Follow-Up:** Total treatment duration is 90 days (3 months), with clinical monitoring documented at regular 15-day intervals.

5. Assessment Methodology and Parameters

5.1 Objective Assessment Criteria

1. Surface Area Measurement (Graph-Metric Evaluation)

The border of each vitiliginous patch is accurately delineated onto a transparent cellophane sheet using a fine-tipped indelible marker. The tracing is transposed onto standard metric graph paper to compute the cumulative surface area in square centimeters (cm^2).

Severity Grade	Lesion Surface Area (cm2)	Equivalent Circular Lesion Radius

Mild	<3.14 cm^2	<1 cm
Moderate	3.14 - 12.57cm^2	1 – 2 cm
Severe	>12.57scm^2	>2 cm

2. Lesion Enumeration (Patch Count)

Severity Grade	Total Discrete Lesion Count
Mild	<5 patches
Moderate	5 - 10 patches
Severe	>10 patches

3. Wood's Lamp Examination and Histopathology

- **Wood's Lamp Fluorescence:** Evaluated before treatment and at the end of 90 days to assess changes in epidermal hypopigmentation borders.
- **Punch Biopsy:** Pre- and post-trial punch biopsies are performed on selected sites to histologically verify melanocyte reactivation, epidermal melanin deposition, and structural recovery of the basal layer.
- **Laboratory Profile:** Routine safety investigations including Complete Blood Count (CBC), Thyroid Profile), and Antinuclear Antibodies (ANA) screening.

5.2 Statistical Analysis Plan

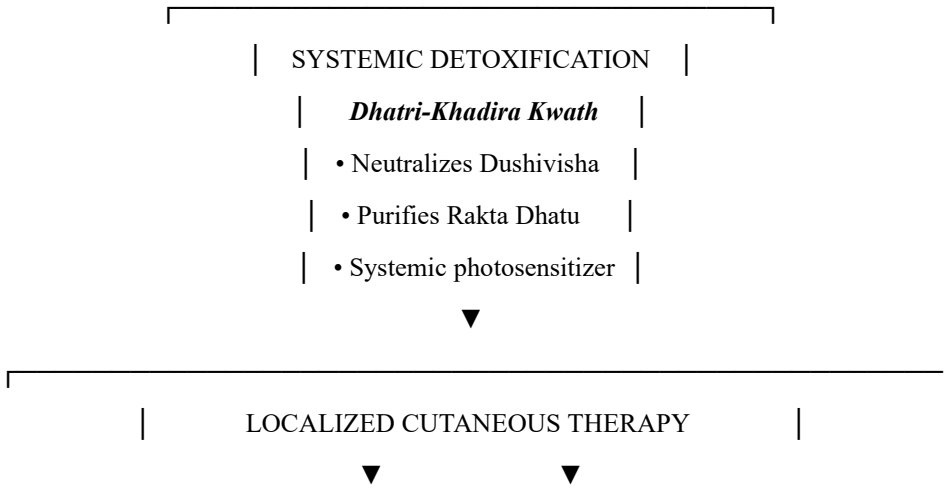
Data recorded from the pre- and post-treatment evaluations across both subjective and objective parameters will be analyzed using statistical software (IBM SPSS Version 26.0 or equivalent).

- **Intra-group comparisons** (Pre-treatment vs. Post-treatment) will be evaluated using the Student's paired t-test for continuous normally distributed variables, or the Wilcoxon signed-rank test for non-parametric data.
- **Inter-group comparisons** (Group 1 vs. Group 2) will be assessed using the Student's unpaired t-test or the Mann-Whitney U test.
- Values of $p < 0.05$ will be considered statistically significant, with $p < 0.001$ indicating high statistical significance.

6. Discussion and Expected Outcomes

The clinical management of *Shvitra* represents a challenge in classical and contemporary medicine. Because *Shvitra* is deeply rooted in *Dushivisha*, an isolated topical intervention is often inadequate. This trial employs a dual-modality approach combining systemic detoxification with localized melanocyte stimulation.

Dual-Action Synergistic Model



Bhallataka-Snuhi Lepa		***Kakodumbradi Lepa***
(Vesicant/Stimulatory)		(Photosensitizing)

1. **Systemic Cleansing (*Shodhana/Shamana*):** *Dhatri-Khadira Kwath* neutralizes circulating *Dushivisha*, pacifies systemic *Pitta-Kapha* morbidity, and purifies *Rakta Dhatu*, removing the biochemical triggers causing melanocyte destruction.
2. **Topical Differences (Group 1 vs. Group 2):**
    - *Bhallataka-Snuhi Lepa* (Group 1) employs an intense, stimulatory approach. Snuhi latex serves as a penetration enhancer that delivers purified Bhallataka to the dermal-epidermal junction. The resulting controlled micro-erythema stimulates follicular melanocyte migration into the depigmented epidermis.
    - *Kakodumbradi Lepa* (Group 2) provides direct topical psoralen saturation coupled with Chitraka's localized circulatory stimulation (*Deepana/Pachana*), promoting melanogenesis upon regular sun exposure.

This comparative study will clarify whether the stimulatory, counter-irritant pathway (*Bhallataka-Snuhi*) or the direct photosensitizing pathway (*Kakodumbradi*) delivers superior, safer, and more sustained repigmentation in clinical practice.

7. CONCLUSION

This research protocol presents a structured clinical model grounded in Ayurvedic principles and modern pharmacological rationale. By addressing both systemic toxicity (*Dushivisha*) via *Dhatri-Khadira Kwath* and localized amelanosis via targeted topical formulations (*Bhallataka-Snuhi Lepa* vs. *Kakodumbradi Lepa*), this study aims to generate clinical and histological evidence for the safe, effective management of *Shvitra* (Vitiligo).

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