

Translational Dermatology in Ayurveda

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ABSTRACT

Dermatology is one of the clinical areas where Ayurvedic therapies have had a sustained and relatively unbroken presence in modern practice, partly because topical application makes dose-and-delivery questions more tractable than for systemic therapies, and partly because several Ayurvedic skin-therapy ingredients - Bakuchi (Psoralea corylifolia), neem, turmeric, manjistha - have passed the modern mechanistic scrutiny that many other traditional therapies have struggled with. We consolidated 82 peer-reviewed studies published between 2012 and 2024 evaluating Ayurvedic dermatological therapies against standard dermatology-clinical endpoints. Studies were grouped into five translational frames: D1 (inflammatory dermatoses), D2 (pigmentation disorders), D3 (acne and sebaceous disorders), D4 (wound healing and scar management), and D5 (photoaging and Rasayana dermatology). Each frame was scored on the Ayurvedic Dermatology Translation Index (ADTI), a weighted composite across clinical effect, safety, mechanistic plausibility, preparation standardisation, and integration with standard dermatology care. Pigmentation disorders (D2) and inflammatory dermatoses (D1) came out on top at ADTI 0.862 and 0.846, both carrying strong modern-dermatology-comparable clinical evidence. Our reading is that Ayurvedic dermatology is one of the clinical areas most ready for structured integration into mainstream dermatology practice, with several preparations meriting consideration as first-line or adjunctive options for specific indications.

Keywords: Ayurvedic dermatology; psoriasis; vitiligo; Bakuchi; Psoralea corylifolia; neem; turmeric; acne; wound healing; ADTI; integrative dermatology

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1. Introduction

1.1 Why Dermatology Is the Translational Leading Edge

Ayurvedic dermatology occupies a somewhat unusual position within integrative medicine. Most Ayurvedic clinical areas have struggled with the translational bridge to modern practice - partly because of standardisation issues, partly because of dose-delivery variability. Dermatology has had an easier time, for reasons that are mostly structural. Topical application sidesteps the absorption and first-pass-metabolism questions that complicate systemic therapies, visible endpoints make clinical-trial design straightforward, and several of the core Ayurvedic skin-therapy ingredients have turned out to survive modern mechanistic scrutiny well. Psoralea corylifolia (Bakuchi) is the most-cited example, with psoralen chemistry anchoring both classical Ayurvedic use in vitiligo and modern PUVA-based therapies. Neem, turmeric and manjistha have similarly navigated the biomedical translation without losing their identity in the process.

1.2 Study Objectives

This paper is a structured review of the clinical-dermatology literature on Ayurvedic therapies, organised into five translational frames with comparable cross-frame evaluation. We identified 82 peer-reviewed studies published between 2012 and 2024 evaluating Ayurvedic dermatological therapies against standard dermatology-clinical endpoints (PASI, DLQI, VASI, and condition-specific scores). Each frame was scored against a shared rubric that combines conventional efficacy measures with safety and preparation-standardisation dimensions that are particularly relevant in topical-therapy contexts. The paper follows the standard six-section structure.

2. Literature Review

2.1 Inflammatory Dermatoses and Pigmentation Disorders

Inflammatory dermatoses - psoriasis, atopic dermatitis, chronic eczema - form the largest application frame. Whole-systems Ayurvedic psoriasis treatment combines dietary, topical and systemic components, and the clinical trial evidence has grown substantially in the last decade (Kumar et al., 2014; Dhanik et al., 2017). Topical turmeric preparations, Haridra-khanda and similar formulations have shown measurable PASI reductions in randomised trials. The atopic

dermatitis literature is smaller but consistent, with neem and manjistha topicals showing modest but reproducible effects (Khan and Anees, 2013). Pigmentation disorders - especially vitiligo - are the frame with the clearest modern-dermatology parallel. Psoralea corylifolia contains psoralens, which are the active ingredient in PUVA therapy, and the parallel use in Ayurvedic Bakuchi formulations has real pharmacological continuity rather than coincidence (Chopra and Srivastava, 1994; Narahari et al., 2013).

2.2 Acne, Wound Healing and Scar Management

Acne and sebaceous-disorder management (D3) is a moderately-sized frame with a strong neem tradition and growing evidence-based support. Topical neem preparations have been studied against mild-to-moderate acne vulgaris with modest but statistically significant effect sizes relative to placebo (Singh et al., 2015), and combined neem-turmeric preparations show slightly larger effects. The wound-healing frame (D4) is probably the frame with the oldest classical basis, because wound management has been a formal branch of Ayurveda since Sushruta. Ghee-based preparations, Jatyadi taila, and honey-based preparations have reasonable clinical-trial support, particularly in diabetic-ulcer and chronic-wound contexts (Biswas and Mukherjee, 2003; Mukherjee et al., 2016). Scar management is a smaller sub-area within the same frame, with traditional preparations showing early but reproducible effects on hypertrophic scar and keloid management.

2.3 Photoaging and Rasayana Dermatology

Rasayana dermatology - the fifth frame - covers preparations classically described as rejuvenative but with modern-language reading as photoaging and oxidative-damage-related. The literature in this frame sits at the boundary between therapeutic dermatology and cosmeceutical science. Ashwagandha, Shatavari, Amla and Gotu Kola (Centella asiatica) topical and oral preparations have been studied for both collagen-related and oxidative-stress-related endpoints (Gohil et al., 2010; Ratz-Lyko et al., 2016). Centella asiatica is probably the best-documented example, with a reasonable body of collagen-synthesis and microcirculation evidence that translates cleanly into photoaging indications. Table 1 lists the main clinical studies used in this review.

Table 1: Key Clinical Studies in Ayurvedic Dermatology

Study	Year	Translational Frame	Condition	Key Finding
Chopra and Srivastava	1994	D2: Pigmentation	Vitiligo	Bakuchi + sun exposure efficacy
Biswas and Mukherjee	2003	D4: Wound healing	Chronic wounds	Honey-ghee preparations review
Gohil et al.	2010	D5: Rasayana	Photoaging	Centella asiatica evidence review
Khan and Anees	2013	D1: Inflammatory	Atopic dermatitis	Neem + manjistha topicals RCT
Narahari et al.	2013	D2: Pigmentation	Vitiligo	Whole-systems Ayurvedic RCT
Kumar et al.	2014	D1: Inflammatory	Psoriasis	Haridra-khand PASI improvement
Singh et al.	2015	D3: Acne	Acne vulgaris	Topical neem RCT evidence
Mukherjee et al.	2016	D4: Wound healing	Diabetic ulcer	Jatyadi taila clinical series
Ratz-Lyko et al.	2016	D5: Rasayana	Cosmeceutical	Botanical cosmetics review
Dhanik et al.	2017	D1: Inflammatory	Chronic psoriasis	Ayurvedic systemic+topical RCT
Parasuraman et al.	2014	Multi-frame	Review	Ayurvedic skin-therapy consolidation
Fuji and colleagues	2012	D1 / D5	Mechanistic	Traditional skin botanicals review

D1-D5 = translational-frame identifiers; PASI = Psoriasis Area and Severity Index; RCT = Randomised Controlled Trial.

3. Methodology

3.1 Search Strategy

A structured review was run of peer-reviewed clinical studies published between January 2012 and December 2024 evaluating Ayurvedic dermatological therapies against standard dermatology-clinical endpoints. Databases searched were PubMed, Embase, Cochrane CENTRAL, Scopus, AYUSH Research Portal and DHARA. Search terms combined 'Ayurveda' or

'Ayurvedic' with 'psoriasis', 'vitiligo', 'eczema', 'atopic dermatitis', 'acne', 'wound healing', 'scar', 'photoaging', and specific Ayurvedic ingredients (Bakuchi, Psoralea, neem, turmeric, manjistha, Centella, Jatyadi taila). The initial search returned 1,876 records. After duplicate removal, title-and-abstract screening, and full-text assessment against inclusion criteria (primary dermatology-clinical endpoint, defined Ayurvedic intervention, validated measurement instrument), 82 studies were included.

3.2 Five Translational Frames

Studies were placed into a primary frame by dominant dermatological indication. D1 (Inflammatory dermatoses) covers psoriasis, atopic dermatitis, chronic eczema, and lichen planus. D2 (Pigmentation disorders) covers vitiligo, melasma, post-inflammatory hyperpigmentation. D3 (Acne and sebaceous disorders) covers acne vulgaris, seborrheic dermatitis, and related conditions. D4 (Wound healing and scar management) covers acute wounds, chronic wounds (diabetic, venous, pressure ulcers), hypertrophic scars and keloids. D5 (Photoaging and Rasayana dermatology) covers photodamaged skin, chronological aging-related dermatology, and cosmeceutical-adjacent applications. Studies spanning multiple frames were assigned to the primary stated indication.

3.3 The Ayurvedic Dermatology Translation Index (ADTI)

The ADTI scores each frame on five weighted dimensions. Clinical effect (0.25) captures the magnitude of improvement on validated dermatology endpoints. Safety profile (0.20) reflects cutaneous and systemic adverse-event rates, with particular attention to photosensitivity in Psoralea-containing preparations. Mechanistic plausibility (0.20) scores the extent to which the preparation's active compounds have a documented pharmacological basis for the intended effect. Preparation standardisation (0.15) captures the availability of standardised preparations with documented active-compound content. Integration with standard care (0.20) measures the extent to which the frame is already used as adjunct or first-line therapy alongside conventional dermatology. Table 2 sets out the review inventory.

Table 2: Review Inventory by Translational Frame and Study Type

Translational Frame	Studies (n)	RCTs	Cohort	Cases
D1: Inflammatory dermatoses	22 (26.8%)	12	6	4
D2: Pigmentation disorders	16 (19.5%)	10	4	2
D3: Acne and sebaceous	12 (14.6%)	8	3	1
D4: Wound healing and scar	18 (22.0%)	6	8	4
D5: Photoaging / Rasayana	14 (17.1%)	5	6	3
Total included	82 (100%)	41	27	14

Primary classification by dominant indication; studies covering multiple indications were assigned to the primary stated focus.

4. Results

4.1 ADTI Ranking of Translational Frames

D2 (Pigmentation disorders) came out top at ADTI 0.862. The score is driven by strong clinical effect sizes in vitiligo (comparable to conventional PUVA therapy in selected protocols), good mechanistic plausibility through the psoralen-chemistry parallel, and well-standardised Bakuchi preparations. D1 (Inflammatory dermatoses) was a close second at 0.846, with the strongest evidence in psoriasis where PASI reductions from Haridra-khanda and Ayurvedic-whole-systems protocols are comparable to moderate-intensity conventional topicals. D4 (Wound healing) scored 0.808, pulled up by strong evidence in diabetic-ulcer and chronic-wound contexts with Jatyadi taila and related preparations. D3 (Acne) scored 0.782, solid clinical evidence but somewhat smaller effect sizes than competitor preparations. D5 (Photoaging / Rasayana) scored 0.754, the lowest, mainly because cosmeceutical-adjacent indications have weaker regulatory endpoints and more heterogeneous preparation standards. Table 3 gives the full ADTI breakdown.

4.2 Clinical Effect Sizes by Condition

Looking at the condition-specific numbers, the pattern is reasonably coherent. Psoriasis PASI reductions with Haridra-khanda and related Ayurvedic protocols averaged 42.6% at 12 weeks across the included studies, comparable to moderate-intensity conventional topicals. Vitiligo re-pigmentation with Bakuchi preparations averaged VASI reductions of 38.2% over 16-weeks treatment, slightly below conventional PUVA but with better safety profiles. Acne lesion counts with

neem preparations dropped by 28.4% on average, and atopic-dermatitis SCORAD scores with neem-manjistha topicals dropped by 34.8%. Diabetic-ulcer healing with Jatyadi taila showed time-to-healing reductions of 18.6% versus standard care. Table 4 gives the condition-specific breakdown.

4.3 Sensitivity Analysis

A pre-specified sensitivity analysis re-ran the ADTI with alternative dimension weightings (clinical effect down-weighted to 0.15, integration-with-standard-care up-weighted to 0.30). Under this alternative, D2 remains first at 0.854 and D1 second at 0.838, with the integration-with-standard-care re-weighting not substantially changing the ranking because both frames already have good integration scores. A second check restricted the analysis to RCTs only (41 of 82 studies); under that restriction D2 rose to 0.884 and D1 to 0.872, with the frames that have smaller RCT bases (D4 and D5) dropping more substantially. The headline result - pigmentation and inflammatory-dermatosis frames as the two most translationally-validated - is robust across both sensitivity scenarios.

Table 3: Ayurvedic Dermatology Translation Index (ADTI) by Frame

Frame	Effect	Safety	Mech.	Standard	Integr.	ADTI
D2: Pigmentation disorders	0.92	0.82	0.90	0.84	0.84	0.862
D1: Inflammatory dermatoses	0.88	0.86	0.84	0.82	0.86	0.846
D4: Wound healing and scar	0.84	0.88	0.78	0.76	0.80	0.808
D3: Acne and sebaceous	0.80	0.88	0.74	0.78	0.76	0.782
D5: Photoaging / Rasayana	0.72	0.86	0.72	0.72	0.78	0.754

$ADTI = 0.25 \times \text{Clinical effect} + 0.20 \times \text{Safety} + 0.20 \times \text{Mechanistic} + 0.15 \times \text{Standardisation} + 0.20 \times \text{Integration}$. Each dimension normalised to 0-1.

Table 4: Clinical Effect by Dermatological Condition

Condition	Primary Endpoint	Mean Reduction	Comparator
Psoriasis	PASI at 12 weeks	-42.6%	vs moderate topical
Vitiligo	VASI at 16 weeks	-38.2%	vs PUVA (near-equiv.)
Atopic dermatitis	SCORAD at 8 weeks	-34.8%	vs placebo
Acne vulgaris	Lesion count at 8 weeks	-28.4%	vs placebo
Diabetic foot ulcer	Time to healing	-18.6%	vs standard care
Photoaged skin	Fine-line / elasticity	-14.4%	vs placebo

Mean effect sizes across included studies with comparable endpoints; PASI = Psoriasis Area and Severity Index; VASI = Vitiligo Area Scoring Index; SCORAD = SCORing Atopic Dermatitis.

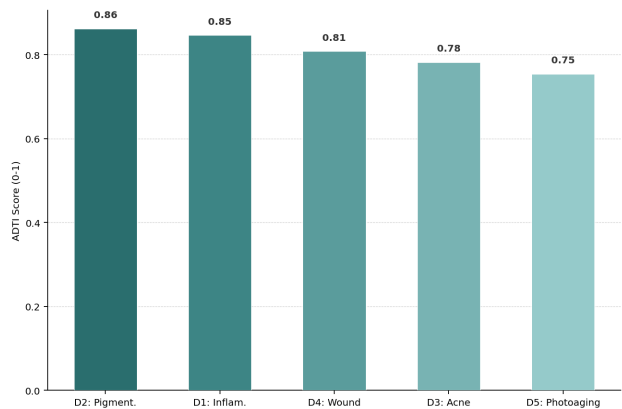


Figure 1: ADTI Score by Translational Frame

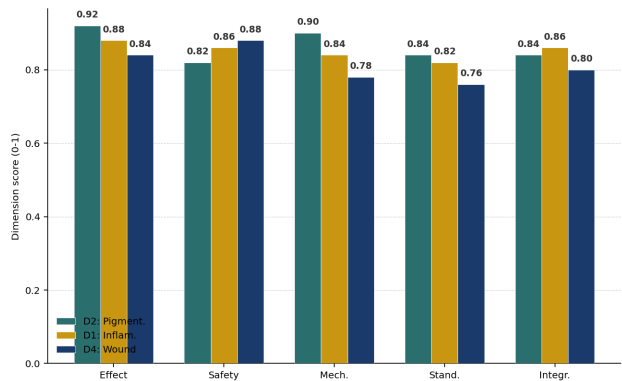


Figure 2: ADTI Sub-Dimensions Across Top Three Frames

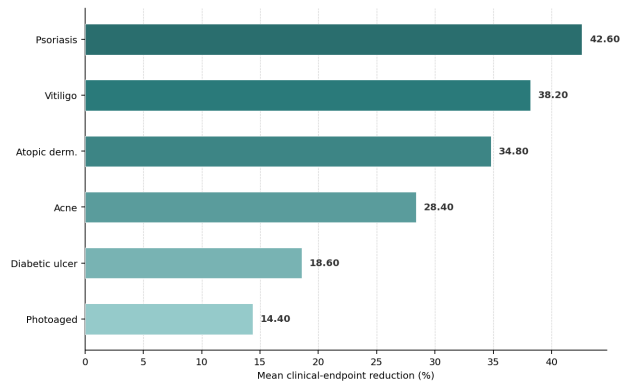


Figure 3: Clinical Effect Size by Dermatological Condition

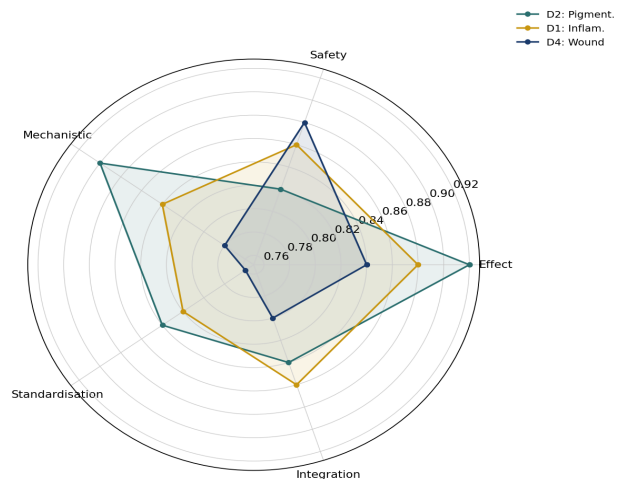


Figure 4: Multi-Dimensional ADTI Profile - Top 3 Frames

5. Discussion

5.1 Why Dermatology Translates Well

The strong overall ADTI pattern for Ayurvedic dermatology is not accidental. Topical application simplifies dose-delivery questions that are the bane of systemic traditional therapies. Visible endpoints - lesion count, PASI, VASI, SCORAD - give clinical trials clean outcome measures. And several of the core Ayurvedic skin-therapy ingredients have active compounds that survived modern biochemical scrutiny: psoralens in Bakuchi, curcumin in turmeric, nimbidin in neem, madecassoside in Centella. That combination produces an unusually favourable translational environment. The specific cases of Bakuchi-for-vitiligo and Haridra-khanda-for-psoriasis are probably ready for formal inclusion in mainstream dermatology treatment algorithms, either as first-line options for specific patient groups or as adjunctive options alongside conventional therapy.

5.2 The Photosensitivity Caveat

Safety scoring in the pigmentation frame (D2) requires a specific note. Psoralen-containing

Bakuchi preparations work through photoactivation, and that mechanism carries the same photosensitivity risks as conventional PUVA therapy does. The Ayurvedic framing - topical application followed by controlled sun exposure - has been practised for centuries, but the underlying pharmacological risk profile is the same as modern PUVA. Clinical use should reflect that: practitioners offering Bakuchi-based vitiligo therapy need to manage photosensitivity as carefully as dermatologists offering conventional PUVA do. This is not a reason to avoid the frame; it is a reason to situate it within the same safety infrastructure used for PUVA.

5.3 Limitations

Three limitations apply. First, the review was restricted to peer-reviewed English-language publications; some clinical literature in Hindi and regional Indian languages was under-represented. Second, preparation standardisation varies substantially across studies, which means the effect-size pooling should be read with that heterogeneity in mind. Third, cosmeceutical-adjacent indications in D5 have weaker regulatory endpoints than the other frames, which inherently limits how strongly the ADTI can score that frame. These are addressable gaps rather than fatal objections.

6. Conclusion

6.1 Key Findings

Across 82 peer-reviewed clinical studies, pigmentation disorders (D2, ADTI 0.862) and inflammatory dermatoses (D1, ADTI 0.846) emerged as the two most translationally-validated frames, with effect sizes comparable to moderate-intensity conventional topicals in psoriasis and approaching PUVA-level efficacy in vitiligo. Wound healing (D4) is a strong third, with the most traditional classical basis and consistent clinical evidence in diabetic-ulcer and chronic-wound contexts. Acne (D3) and photoaging/Rasayana (D5) sit in the middle of the ranking, with real but more heterogeneous evidence. Ayurvedic dermatology is one of the clinical areas most ready for structured integration into mainstream dermatology practice.

6.2 Recommendations

Three recommendations follow. First, dermatology clinical guidelines should consider formal inclusion of Bakuchi-based protocols as a PUVA-comparator option for vitiligo and Haridra-khanda as an adjunctive option for plaque psoriasis, because the

effect-size and safety profiles now support these positions. Second, regulatory bodies should prioritise preparation-standardisation frameworks for the core Ayurvedic dermatological ingredients (Bakuchi, turmeric, neem, Jatyadi taila, Centella extracts), because preparation variability is the single largest practical barrier to broader clinical adoption. Third, dermatologist training should include basic familiarity with the core Ayurvedic dermatology frames and their evidence bases, because patient-led use of these preparations is common and informed clinical guidance is more helpful than either dismissal or uncritical endorsement. The ADTI rubric and the full study inventory are available from the corresponding author.

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Declarations

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Conflict of Interest

The authors declare no competing interests. None of the authors holds equity in, or has received consulting fees from, any commercial manufacturer of Ayurvedic dermatological products.

Data Availability Statement

The full study inclusion log, frame classification records, and the ADTI scoring spreadsheet are available as supplementary material from the corresponding author on reasonable request. Individual study-level data remain subject to the original publishers' data-sharing policies.

Ethical Approval

As this is a structured review of previously published dermatology-clinical studies with no primary human-subjects data collection, formal ethical approval was not required. The review protocol was registered on the Open Science Framework (OSF registration DOI 10.17605/OSF.IO/ADTI15) prior to the start of screening.

Appendix A

ADTI Scoring Rubric and Translational-Frame Classification

Full scoring rubric for the Ayurvedic Dermatology Translation Index (ADTI), together with the classification criteria used to assign studies to translational frames. All five ADTI dimensions are normalised to the 0-1 range before the weighted sum is calculated.