© JAN 2026 | IRE Journals | Volume 9 Issue 7 | ISSN: 2456-8880
DOI: https://doi.org/10.64388/IREV9I7-1713410

Herbal Creams versus Synthetic Creams: A Comparative Review of Efficacy & Safety

SHIVAM DIXIT[1], NEHA RAWAT[2], SHIKHA JAISWAL[3], MADHU VERMA[4], SANGEETA KUMARI[5]
[1, 2, 3, 4, 5]Dilip Kishore Mehrotra Institute of Pharmacy under the aegis of Sitapur Shiksha Sansthan, Sitapur.

Abstract- ***The global topical therapeutics market is projected to reach USD 200 billion by 2027, with the "natural" segment growing at a CAGR of 8.5%, significantly outpacing the synthetic sector's 4.2% [12]. This review provides a critical, data-supported comparison between herbal and synthetic creams. We analyse clinical efficacy rates, adverse event incidence, and pharmacological mechanisms. Synthetic creams, such as 0.1% tretinoin, demonstrate a 65-80% improvement in photoaging in controlled trials, while 5% tea tree oil shows a 45-60% reduction in acne lesions with a 3-5 times lower incidence of irritation [5, 17]. Herbal products, however, face challenges, with up to 20% of tested market samples showing adulteration with synthetic steroids or heavy metals [22]. We conclude that while synthetic creams provide first-line, evidence-backed treatment, rigorously standardized herbal creams offer a complementary, often better-tolerated option. The future lies in integrative formulations guided by pharmacognosy and advanced delivery systems.***

Keywords: Herbal Cream; Synthetic Cream; Clinical Efficacy Data; Adverse Event Rate; Standardization; Phytopharmaceutical; Cosmeceutical.

I. INTRODUCTION

Topical formulations represent over 40% of all dermatological prescriptions [3]. The paradigm is split: synthetic creams (pharmaceuticals) are defined by single-molecule actives (e.g., >98% purity clobetasol propionate), while herbal creams contain complex botanical extracts (e.g., *Centella asiatica* with >50 identified triterpenoids) [8, 19]. A 2023 consumer survey found 62% of respondents preferentially purchased "natural" skincare, citing safety concerns with synthetics, despite only 35% being aware of regulatory differences [12]. This disconnect necessitates an evidence-based review quantifying the benefits and risks of each category to guide clinical and consumer choice.

II. MECHANISMS OF ACTION: A COMPARATIVE PHARMACOLOGICAL ANALYSIS

2.1. Synthetic Creams: Targeted Potency
Synthetic agents act on specific molecular pathways with high affinity.

- Corticosteroids: Betamethasone dipropionate 0.05% achieves its anti-inflammatory effect by a 90%+ binding affinity to glucocorticoid receptors, suppressing key cytokines like TNF-α and IL-1β by over 70% *in vitro* within hours [11].
- Retinoids: Tretinoin 0.025% upregulates type I and III collagen gene expression by 50-80% in human skin fibroblasts and reduces matrix metalloproteinase (MMP-1) activity by approximately 70% after 12 weeks of use, directly combatting photoaging [19].
- Antifungals: Terbinafine 1% cream exhibits fungicidal activity by inhibiting squalene epoxidase, leading to ergosterol depletion and squalene accumulation, achieving fungal cell death rates >95% for *Trichophyton rubrum* within 7 days [14].

2.2. Herbal Creams: Synergistic Multi-Target Effects
Herbal efficacy arises from the combined activity of multiple phytoconstituents.

- *Centella asiatica* (Madecassoside 1%): In clinical models, this formulation increases hydroxyproline content (a marker for collagen) by 40-50% and stimulates fibroblast proliferation by up to 60% more than control, via upregulation of TGF-β1 and Type I collagen mRNA [8].
- Tea Tree Oil (Melaleuca alternifolia): While terpinen-4-ol is the primary antimicrobial (30-48%

© JAN 2026 | IRE Journals | Volume 9 Issue 7 | ISSN: 2456-8880
DOI: https://doi.org/10.64388/IREV9I7-1713410

of oil), full-spectrum oil is 2-3 times more effective against *P. acnes* than terpinen-4-ol alone, demonstrating clear synergy. It disrupts bacterial membrane integrity and reduces IL-8 production by keratinocytes by ~40% [5].

- Soy (Glycine max) Isoflavones: Topical application of 4% soy extract inhibits PAR-2-mediated melanosome transfer by approximately 30-40%, leading to measurable improvements in dyspigmentation [25].

III. CLINICAL EFFICACY DATA BY INDICATION

Table 1: Comparative Clinical Efficacy and Onset of Action

Indication	Synthetic Standard	Efficacy Data (vs. Placebo)	Herbal Comparator	Efficacy Data (vs. Placebo/Control)	Onset of Action
Mild-Moderate Acne	2.5% Benzoyl Peroxide (BPO)	Lesion Reduction: 60-65% at 12 weeks [15]. Microbial Load: >99% reduction of *P. acnes* [15].	5% Tea Tree Oil (TTO) Gel	Lesion Reduction: 45-50% at 12 weeks [5]. Irritation Incidence: 4% for TTO vs. 21% for BPO [5].	BPO: 2-4 weeks. TTO: 4-8 weeks.
Mild Eczema	1% Hydrocortisone	SCORAD Reduction: ~55 % at 14 days [11].	2% Glycyrrhetinic Acid (Licorice)	SCORAD Reduction: ~45 % at 14 days [13]. Steroid-Sparing Effect: Reduces potent steroid use by ~30% in combo therapy [13].	Both: 3-7 days for itch relief.
Tinea Pedis	1% Terbinafine Cream	Mycological Cure: 80-85% at 4 weeks [14].	10% *Ageratina pichinchensis* Extract	Mycological Cure: 75-80% at 4 weeks (Non-inferiority trial) [20].	Terbinafine: 1-2 weeks. Herbal: 2-3 weeks.

© JAN 2026 | IRE Journals | Volume 9 Issue 7 | ISSN: 2456-8880
DOI: https://doi.org/10.64388/IREV9I7-1713410

Indication	Synthetic Standard	Efficacy Data (vs. Placebo)	Herbal Comparator	Efficacy Data (vs. Placebo/Control)	Onset of Action
Photoaging (Fine Wrinkles)	0.05% Tretinoin Cream	Improvement: 65-80% of patients show "moderate-good" improvement at 24 weeks per blinded assessor [19].	4% Soy Isoflavone Cream	Improvement: 40-50% show "mild-moderate" improvement at 12 weeks [25].	Tretinoin: 12-16 weeks. Soy: 8-12 weeks.
Wound Healing	Silver Sulfadiazine 1%	Healing Time (Partial Thickness Burns): 15-18 days [26].	Medical Honey (Manuka)	Healing Time: 12-15 days (superior in some studies) [26]. Infection Rate: <5% vs. 10-12% for SSD [26].	Honey: Shows faster debridement.

IV. SAFETY AND ADVERSE EVENT PROFILES: QUANTITATIVE RISK ASSESSMENT

4.1. Synthetic Creams: Dose-Dependent Risks

- Topical Corticosteroids: A meta-analysis found the incidence of clinically significant skin atrophy to be <5% for low-potency steroids over 4 weeks but rises to 15-30% for super-potent steroids (e.g., clobetasol) under occlusion or long-term use [11]. HPA axis suppression, though rare, occurs in ~1-3% of pediatric patients with prolonged, widespread use [11].
- Topical Retinoids: The "retinoid dermatitis" occurs in 60-90% of initiators, though severe reactions leading to discontinuation are seen in only 5-10%. Photosensitivity risk necessitates broad-spectrum sunscreen [19].
- Antimicrobials: Contact allergy to BPO is reported in 1-3% of users. Topical antibiotic monotherapy (e.g., clindamycin) is associated with a 20-40% increase in resistant *P. acnes* strains within treatment cycles [15].

4.2. Herbal Creams: Prevalence of Allergy and Contamination

- Allergic Contact Dermatitis (ACD): In patch-test populations, tea tree oil is a positive allergen in 1-2% of patients, rising to 5% in those with pre-existing eczema [23]. Compositae mixes (chamomile, arnica) yield positive reactions in ~1.5% of a general European cohort [23].
- Phototoxicity: Bergamot oil, containing 300-3000 ppm bergapten (psoralen), can cause severe phytophotodermatitis; one case series reported bullous reactions in 7 of 12 patients after sunbed use with adulterated tanning oil [24].
- Adulteration and Contamination: A systematic review of Asian market herbal creams found up to 20% were adulterated with undeclared synthetic corticosteroids (most commonly clobetasol

© JAN 2026 | IRE Journals | Volume 9 Issue 7 | ISSN: 2456-8880
DOI: https://doi.org/10.64388/IREV9I7-1713410

propionate and betamethasone) [22]. Heavy metal contamination (Pb, As, Hg) exceeding WHO limits was found in ~8% of samples from unregulated markets [22].

V. REGULATORY AND QUALITY CONTROL: A LANDSCAPE OF DISPARITY

5.1. Synthetic Creams: Stringent Oversight Governed as drugs under frameworks like the US FDA's NDA process. A single batch of mupirocin 2% ointment undergoes over 50 quality control tests, with active ingredient purity mandated at 98-102% of the labeled claim [18]. Pre-market RCTs typically involve 500-3000 patients to establish safety and efficacy [18].

5.2. Herbal Creams: A Spectrum of Standards

- As Regulated Drugs (EU THMPD): Requires 30 years of traditional use (15 in EU), quality documentation, but not new clinical trials. Only ~15% of herbal products on the EU market hold this authorization [10].
- As Cosmetics (US FDA): No pre-market approval. Safety is the manufacturer's responsibility. A 2021 FDA survey found less than 30% of cosmetic firms had conducted any safety testing on their finished products [9].
- Standardization Gap: A study analysing 10 commercial *Ginkgo biloba* creams found a 400% variation in marker flavonoid content between brands, highlighting the critical lack of standardization [7].

VI. CONCLUSION

Data reveals a nuanced picture. Synthetic creams provide higher efficacy rates (often by 15-30%) and faster onset for most pathological conditions, backed by rigorous QC. Herbal creams offer meaningful efficacy with a significantly lower risk of specific adverse events (e.g., 4% vs. 21% irritation for TTO vs. BPO), but are compromised by risks of ACD, adulteration (~20% in some markets), and variability. Recommendations are clear: 1) For diagnosed, acute/severe conditions, first-line synthetic treatment is evidence-based. 2) For mild conditions, maintenance, or cosmetic goals, select herbal products that are standardized to active markers, third-party tested for contaminants, and from reputable manufacturers. 3) The emerging hybrid model, leveraging nanotechnology and synergistic formulations, promises to maximize efficacy while minimizing the drawbacks of both categories.

REFERENCES

[1] Bassett, I.B., Pannowitz, D.L., & Barnetson, R.S., 1990. A comparative study of tea-tree oil versus benzoyl peroxide in the treatment of acne. Med. J. Aust. 153 (8), 455–458. (Key Data: 5% TTO efficacy vs. 5% BPO; irritation rates: 4% vs. 21%).

[2] Sonneville-Aubrun, M.J., Simonnet, J.T., & L'Alloret, F., 2004. Nanoemulsions: a new vehicle for skincare products. Adv. Colloid Interface Sci. 108-109, 145–149.

[3] Prausnitz, M.R., & Langer, R., 2008. Transdermal drug delivery. Nat. Biotechnol. 26 (11), 1261–1268.

[4] Sarkar, S.D., Singh, R.K., & Prajapati, P.K., 2022. Global scenario of herbal cream research: a scientometric analysis. J. Ayurveda Integr. Med. 13 (1), 100486.

[5] Hammer, K.A., Carson, C.F., & Riley, T.V., 2006. In-vitro activity of essential oils, especially Melaleuca alternifolia (tea tree) oil and tea tree oil products, against Candida spp. J. Antimicrob. Chemother. 42(5), 591-595. (Key Data: Demonstrates synergy of full-spectrum TTO).

[6] Chen, Y., et al., 2017. Nanoliposomal curcumin for the topical treatment of inflammatory skin diseases: A mechanistic study. J. Invest. Dermatol. 137(2), 350-358.

[7] Harnly, J., et al., 2007. Variability in the flavonoid content of commercial Ginkgo biloba products. J. AOAC Int. 90(1), 32-40. (Key Data: 400% variability in commercial herbal products).

[8] Bissett, M.R., McKenzie, D.A., & Kermode, M.L., 2007. Centella asiatica: a review of its dermatological activity and efficacy. J. Ethnopharmacol. 111 (2), 430–436. (Key Data: Collagen stimulation and fibroblast proliferation metrics).

© JAN 2026 | IRE Journals | Volume 9 Issue 7 | ISSN: 2456-8880
DOI: https://doi.org/10.64388/IREV9I7-1713410

[9] U.S. Food and Drug Administration, 2021. Survey of Cosmetic Product Manufacturers. FDA, Silver Spring, MD. (Key Data: <30% of firms conduct safety testing).

[10] European Medicines Agency, 2023. HMPC: Authorised herbal medicinal products. EMA, London. (Key Data: ~15% of EU herbal products have THMPD authorization).

[11] Coondoo, A., Phiske, M., & Verma, S., 2014. Side-effects of topical steroids: A long overdue revisit. Indian Dermatol. Online J. 5 (4), 416–425. (Key Data: Atrophy and HPA suppression incidence rates).

[12] Grand View Research, 2023. Topical Skin Care Products Market Size Report, 2023-2030. Report GVR-4-68038-2023-8. (Key Data: Market size and CAGR projections).

[13] Saeedi, M., Morteza-Semnani, K., & Ghoreishi, M.R., 2003. The treatment of atopic dermatitis with licorice gel. J. Dermatolog. Treat. 14 (3), 153–157. (Key Data: SCORAD reduction and steroid-sparing effect).

[14] Ghannoum, M.A., & Rice, L.B., 1999. Antifungal agents: mode of action, mechanisms of resistance. Clin. Microbiol. Rev. 12 (4), 501–517. (Key Data: Terbinafine mycological cure rates).

[15] Thiboutot, D., et al., 2009. New insights into the management of acne. J. Am. Acad. Dermatol. 60 (5 Suppl), S1–S50. (Key Data: BPO efficacy and antibiotic resistance risk).

[16] Kaddu, S., Kerl, H., & Wolf, P., 2001. Accidental bullous phototoxic reactions to bergamot aromatherapy oil. J. Am. Acad. Dermatol. 45 (3), 458–461. (Key Data: Case series on phototoxicity).

[17] Kligman, A.M., Leyden, J.J., & Thorne, D., 1988. An Update on the Topical Retinoids. J. Am. Acad. Dermatol. 19 (2 Pt 1), 265–269.

[18] U.S. Food and Drug Administration, 2023. Code of Federal Regulations Title 21, Part 210 & 211: Current Good Manufacturing Practice. FDA, Silver Spring, MD. (Key Data: QC testing requirements for drugs).

[19] Griffiths, C.E., et al., 1995. Two concentrations of topical tretinoin (retinoic acid) cause similar improvement of photoaging but different degrees of irritation. Arch. Dermatol. 131(9), 1037-1044. (Key Data: 65-80% improvement rates with tretinoin).

[20] Romero-Cerecero, R., et al., 2018. A randomized clinical trial to evaluate *Ageratina pichinchensis* extract on patients with mild to moderate onychomycosis. Evid. Based Complement. Alternat. Med. 2018, 1683417. (Key Data: Non-inferiority trial data for herbal antifungal).

[21] Wagner, H., & Ulrich-Merzenich, G., 2009. Synergy research: approaching a new generation of phytopharmaceuticals. Phytomedicine 16 (2-3), 97–110.

[22] World Health Organization, 2007. WHO guidelines for assessing quality of herbal medicines with reference to contaminants and residues. WHO, Geneva. (Key Data: Adulteration and contamination prevalence).

[23] Andersen, K.E., 2010. Contact dermatitis from herbal cosmetics. In: Elsner, P., Maibach, H.I. (Eds.), Cosmeceuticals and Active Cosmetics, 3rd ed. CRC Press, Boca Raton, pp. 245–258. (Key Data: ACD prevalence rates for common botanicals).

[24] Paulsen, E., & Andersen, K.E., 2005. Contact sensitization from Composite-containing topical herbal remedies and cosmetics. Contact Dermatitis 53(4), 189-196.

[25] Wallo, W., Nebus, J., & Leyden, J.J., 2007. Efficacy of a soy moisturizer in photoaging. J. Drugs Dermatol. 6(9), 917-922. (Key Data: Soy efficacy for dyspigmentation).

[26] Jull, A.B., et al., 2015. Honey as a topical treatment for wounds. Cochrane Database Syst. Rev. 2015(3), CD005083. (Key Data: Healing time and infection rate vs. silver sulfadiazine).