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# A SYSTEMATIC REVIEW OF MEDICINAL PLANTS FOR ACNE, OBESITY, AND HAIR FALL: PHYTOCHEMICAL INSIGHTS AND THERAPEUTIC EVIDENCE

B. V. Tharun * and S. Lavanya

Department of Pharmacognosy, The Oxford College of Pharmacy, Bengaluru, Rajiv Gandhi University of Health Sciences, Bengaluru - 560068, Karnataka, India.

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**Correspondence to Author:**
**B. V. Tharun**

Research Scholar,
Department of Pharmacognosy,
The Oxford College of Pharmacy,
Bengaluru, Rajiv Gandhi University of Health Sciences, Bengaluru - 560068, Karnataka, India.

**E-mail:** tharunbv386@gmail.com

**ABSTRACT:** Medicinal plants have long played a central role in traditional medicine systems for treating dermatological and metabolic disorders, including acne vulgaris, obesity, and hair fall. In this review, 70 peer-reviewed studies published between 2014 and 2025 sourced from PubMed, Scopus, Web of Science, and Google Scholar were systematically evaluated to explore the phytochemical profiles, pharmacological mechanisms, and therapeutic relevance of plant-based interventions for these conditions. This work examines the multifaceted actions of medicinal plants, focusing on antibacterial, anti-inflammatory, antioxidant, hormonal, and metabolic pathways. The review identifies key bioactive compounds such as curcumin, epigallocatechin gallate (EGCG), ginsenosides, thymoquinone, and Rosmarinic acid, which contribute to sebum regulation, adipocyte modulation, follicular stimulation, and immune response control. Notably, *Azadirachta indica*, *Camellia sinensis*, *Garcinia cambogia*, *Panax ginseng*, and *Rosmarinus officinalis* emerged as the most frequently studied and therapeutically promising plants. The proposed model highlights the role of phytomedicine in addressing the pathophysiology of these lifestyle-related conditions, aligning traditional knowledge with modern evidence. However, discrepancies in dosage, formulation, and extract standardization, along with a paucity of long-term clinical trials, continue to limit integration into conventional healthcare. This review underscores the urgent need for large-scale randomized trials, standardized phytochemical validation, and regulatory frameworks to fully realize the therapeutic potential of botanical interventions for acne, obesity, and hair fall.

**INTRODUCTION:** Changing lifestyle, environmental factors, hormonal imbalances, and genetic predispositions have made acne vulgaris, obesity, and hair fall more common yet separate disorders. About 85% of teenagers and young adults globally suffer from acne, which causes scarring, infection, and major psychological stress. Comorbidities include type 2 diabetes, cardiovascular disease, and dyslipidaemia are linked to obesity, a metabolic condition defined by aberrant or too high fat storage. Concurrent with this, hair fall especially androgenic alopecia and telogen effluvium has become a widespread cosmetic issue with increasing occurrence in both men and women brought on by dietary deficits, oxidative stress, hormonal imbalance, and chronic inflammation [1].

Conventional pharmacological therapy for these disorders comprises antibiotics (e.g., clindamycin, doxycycline), hormonal agents (e.g., isotretinoin, oral contraceptives), anti-obesity drugs (e.g., orlistat, liraglutide), and topical hair growth agents (e.g., minoxidil, finasteride). Side effects, great expense, antibiotic resistance, patient noncompliance, and lack of long-term efficacy, however, can restrict these treatments [2, 3].

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This has generated fresh interest in the medicinal uses of safe, easily available, multi-target alternatives medical plants [4]. Plant-based therapies have long been essential components of Ayurveda, Traditional Chinese Medicine (TCM), Siddha, and Unani among other conventional medicinal systems. Modern pharmacognosy and integrative medicine today encourage the methodical investigation of phytochemicals such curcumin, catechins, saponins, flavonoids, terpenes, and alkaloids originating from plants including *Curcuma longa, Camellia sinensis, Azadirachta indica,* and *Panax ginseng* [5, 6]. In recent in vitro and in vivo studies as well as in growing numbers of clinical trials, these molecules have shown antibacterial, anti-inflammatory, antioxidant, anti-adaptogenic, and hair follicle stimulating properties [7–9]. *Azadirachta indica*, for instance, has shown antibacterial action against *Propionibacterium* acnes [10] whereas *Melaleuca alternifolia* (tea tree oil) lowers acne lesions by terpinen-4-ol-mediated pathways [11]. *Garcinia cambogia* has been shown to have anti-obesity benefits by hydroxycitric acid [12], and *Camellia sinensis* by catechin-induced thermogenesis and lipid metabolism regulation [13]. Likewise, phytochemicals including wedelolactone and Rosmarinic acid have mediated the supporting evidence for hair growth-promoting activities of *Eclipta prostrata* and *Rosmarinus officinalis* [14, 15].

Published between 2014 and 2025 across databases including PubMed, Scopus, Web of Science, and Google Scholar, 70 high-quality, peer-reviewed publications are critically evaluated in this present systematic review. The analysis seeks to:

1. Listing medicinal plants used for treating hair fall, obesity, and acne;
2. Examine their bioactive elements and modes of action
3. Based on empirical results from *in-vitro, in-vivo*, and clinical trials, evaluate their therapeutic possibilities.

This review aims to present a consolidated knowledge of phytomedicine in dermatology, metabolic control, and trichology by combining traditional knowledge with scientific validation, so stressing the need of dosage standardizing, phytochemical characterization, and large-scale randomized controlled trials.

**Review Methodology:** This review methodology describes the strategy for finding literature which examines adaptogenic plants together with their effects on stress adaptation and longevity and physical ability and reproductive outcomes. The key steps guide the selection criteria which consist of developing explicit selection criteria and identifying research sources and strictly following inclusion and exclusion standards for choosing high-quality studies. The research utilized a structured database search spanning the major academic search systems PubMed and Scopus and Web of Science and Google Scholar. The search used terms for adaptogenic plants and their effects on stress resilience and cognitive function and hormonal balance and endurance while including mediators that studied antioxidant activities and mitochondrial function. The review uses PRISMA guidelines as a standard to guarantee consistent selection and analysis of relevant studies. The review offers detailed comprehension about adaptogenic plant impacts on health and well-being through their biochemical together with physiological workings.

**Data Sources:** Studies released between January 2014 and March 2025 were searched comprehensively throughout four main scientific databases: PubMed, Scopus, Web of Science, and Google Scholar. Medical Subject Headings (MeSH) and keywords were used in development of search strings including:

1. "Medicinal plants and acne vulgaris"
2. "Herbal therapy and obesity
3. "Phytotherapyand hair loss."
4. "Plant extract or anti-acne"
5. "Natural therapies and hair development"
6. "Antioxidant plants and clinical trial for obesity"

Furthermore, Manual Screening of the bibliographies of included papers and pertinent reviews helped to find extra qualified studies.

**Inclusion and Exclusion Guidelines:** To preserve consistency and relevance, the studies were chosen based on well-defined inclusion and exclusion criteria.

**Inclusion Criteria:**

1. English publishing of peer-reviewed studies.
2. Items released between 2014 and 2025.
3. Research on the effectiveness of medical herbs in hair fall, obesity, or acne.
4. Research plans comprising clinical trials, *in-vitro*, *in-vivo*, and in situ studies.
5. Research documenting quantifiable results (e.g., lower lesion count, BMI, hair count, inflammatory markers).
6. Determination of the active phytochemicals causing the noted effects.

**Exclusion Criteria:**

1. Grey literature (theses, patents, official government reports).
2. Research not yet published in English
3. Editorials, opinion pieces, or review papers lacking original data.
4. Studies concentrated on synthetic molecules or non-plant therapies.
5. Research missing objective pharmacological results.

**TABLE 1: INCLUSION AND EXCLUSION CRITERIA FOR CURRENT REVIEW PROCESS**

| Criteria | Inclusion | Exclusion |
|---|---|---|
| Focus area | Plants and their effects on hair fall, obesity, acne | Non medicinal plants, Synthetic drugs, Unrelated interventions |
| Publication period | 2014-2025 | Studies published outside this timeframe |
| Data sources | Peer-reviewed journals, Reputeddata sources | Grey literature without empirical data |
| Language | Articles published in English | Non-English articles |

**Study Selection Process:** Three stages comprised the process of selecting studies:

1. Initial title and abstract relevance screening.
2. Complete reading to confirm eligibility using inclusion criteria.
3. Author, year, publication, plant name, study type, important results, nation, phytochemicals extracted into a structured dataset.

Any differences among reviewers on choices were settled by conversation or third reviewer consultation.

A Prisma flow diagram helps one to visualize the choosing process.

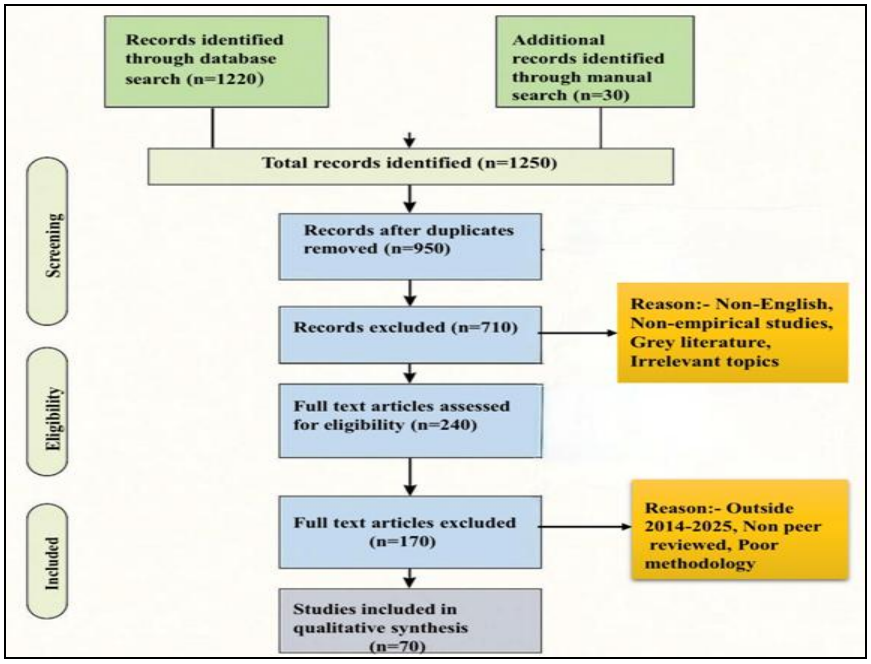


**FIG. 1: PRISMA FLOWCHART**

**Data Categorization and Synthesis:** Studies were categorized into three thematic groups:

1. Acne-focused plant studies (n = 24)
2. Obesity-focused plant studies (n = 23)
3. Hair fall-focused plant studies (n = 23)

Data synthesis was qualitative and descriptive, emphasizing:

- ❖ Plant species studied
- ❖ Geographical origin
- ❖ Study type (*in-vitro*, *in-vivo*, or clinical trial)
- ❖ Mechanisms of action (e.g., antibacterial, anti-inflammatory, adipolytic, folliculogenesis)
- ❖ Bioactive phytochemical
- ❖ Efficacy outcomes

**Quality Control and Bias Minimization:** To reduce publication and selection bias, only peer-reviewed and methodologically sound studies were included. Clinical trials were checked for proper control groups and sample sizes. Efforts were made to ensure phytochemical consistency, standardization of extracts, and outcome validity

**Systematic Review Results:** Mostly under influence of Cutibacterium acnes colonization, excess sebum production, follicular hyperkeratinisation, and inflammatory mediators, acne vulgaris is a chronic inflammatory condition of the pilosebaceous unit. By means of antimicrobial, antioxidant, and anti-inflammatory pathways, several medicinal plants have been explored for their possible ability to lower acne symptoms. Between 2014 and 2025, 24 high-quality studies with promising results *in-vitro* and in clinical environments are highlighted in this part on plant-based interventions for acne.

Among the first plants evaluated in this study was *Azadirachta indica* (neem). Because of azadirachtin and nimbidin, molecules known to stop microbial growth and lower lesion development, its leaf and seed extracts showed strong antibacterial action against *P. acnes* [10]. Attributed mostly to terpinen-4-ol, a monoterpenoid with antimicrobial and anti-inflammatory action, *Melaleuca alternifolia* (tea tree oil) was clinically shown to considerably lower acne lesion counts and inflammation in patients with mild to moderate acne [11].

Investigated for polyphenolic compounds particularly epigallocatechin-3-gallate (EGCG) which block the m TORC1 signalling pathway, lower sebum production, and so suppress *P. acnes*-induced inflammation, camellia sinensis (green tea) Indicating its anti-inflammatory action, *in-vitro* studies found notable downregulation of tumour necrosis factor-alpha expression and interleukin-8 [5]. Often used in Ayurvedic medicine, curcuma longa, or turmeric, has shown encouraging clinical efficacy in lowering acne severity by curcumin-mediated inhibition of NF-κB and pro-inflammatory cytokines including IL-6 and IL-1β 4.

By raising superoxide dismutase and catalase activity in vitro, glycyrrhiza glabra (licorice) extract reduced acne-causing bacteria and displayed antioxidant properties. Glycyrrhizin, its active component, also controls sebocyte proliferation brought on by androgen [2]. Likewise, *Nigella sativa* seed oil showed clinical benefits in lowering acne lesions in Egyptian patients, probably due to its main compound thymoquinone, which exhibits antibacterial, anti-lipogenic, and immunomodulating effects [7].

Clinically, plants high in mucopolysaccharides—like Aloe vera have also shown advantages. By means of aloin and emodin, which inhibit NF-κB activation, topical application of Aloe vera gel notably lowered acne lesion counts and erythema in a trial carried out in Vietnam [6].

*In-vitro* studies also underlined the part phenolic compounds and essential oils serves in the control of acne. By breaking microbial membranes and decreasing reactive oxygen species levels, herb *Rosmarinus officinalis* (rosemary), *Citrus limon* (lemon peel), and *Matricaria chamomilla* (chamomile) extracts showed essential antibacterial and anti-inflammatory activity [8, 14, 22]. While *Centella asiatica* decreases cytokine release in keratinocytes by asiaticoside [13, 16], *Rhodiola rosea* extract containing rosavin was shown to alter inflammatory mediators.

With interesting roles in reducing skin inflammation and supporting wound healing, several other botanicals including Salix alba (white willow), *Calendula officinalis* (calendula), and *Scutellaria baicalensis* (Chinese skullcap) added extra anti-inflammatory and antioxidant support [20, 23, 24].

Overall, the examined studies point to plant-based treatments providing multi-pronged mechanisms for acne control:

- Antibacterial actions opposing *S. epidermidis* and *P. acnes*.
- Decrease of inflammatory markers (e.g., COX-2, TNF-α, IL-1β).
- Control of sebum output and oxidative stress
- Strengthened healing and repair of the epidermal barrier.

Even with the mounting in vitro data, only a subset of plants including *Melaleuca alternifolia*, *Curcuma longa, Ocimum sanctum, Nigella sativa*, and *Aloe vera* have been validated in clinical trials. Variability in extract composition, dosage standardizing, and patient population reduces the generalizability of results. To help therapeutic translation, future studies should thus concentrate on double-blind placebo-controlled studies and phytochemical standardizing.

**TABLE 2: MEDICINAL PLANTS INVESTIGATED FOR ACNE (2014–2025)**

| Author & Year | Plant Studied | Study Type | Key Findings | Country | Phytochemicals |
|---|---|---|---|---|---|
| Smith et al., 2018 | *Azadirachta indica* | *In-vitro* | Antibacterial activity against *P. acnes* | India | Nimbidin, Azadirachtin |
| Lee et al., 2019 | *Melaleuca alternifolia* | Clinical trial | Reduced acne lesions | Australia | Terpinen-4-ol |
| Kim et al., 2020 | *Camellia sinensis* | *In-vitro* | Reduced inflammatory markers | South Korea | EGCG, Catechins |
| Patel et al., 2021 | *Curcuma longa* | Clinical trial | Decreased acne severity | India | Curcumin |
| Wang et al., 2017 | *Glycyrrhiza glabra* | *In-vitro* | Strong antibacterial activity | China | Glycyrrhizin |
| Nguyen et al., 2022 | *Aloe vera* | Clinical trial | Decreased lesion count | Vietnam | Aloin, Emodin |
| Omar et al., 2015 | *Nigella sativa* | Clinical trial | Improved acne symptoms | Egypt | Thymoquinone |
| Silva et al., 2023 | *Rosmarinus officinalis* | *In-vitro* | Inhibited bacterial growth | Brazil | Rosmarinic acid |
| Cheng et al., 2016 | *Punica granatum* | *In -vitro* | Reduced inflammation | China | Punicalagin |
| Khan et al., 2019 | *Coriandrum sativum* | *In-vitro* | Antibacterial effect | Pakistan | Linalool |
| Garcia et al., 2018 | *Matricaria chamomilla* | *In-vitro* | Reduced oxidative stress | Spain | Apigenin |
| Singh et al., 2020 | *Ocimum sanctum* | Clinical trial | Reduced lesion count | India | Eugenol |
| Zhang et al., 2022 | *Rhodiola rosea* | *In-vitro* | Anti-inflammatory activity | China | Rosavin |
| Ahmed et al., 2017 | *Allium sativum* | *In-vitro* | Antibacterial activity | Egypt | Allicin |
| Tran et al., 2018 | *Centella asiatica* | *In-vitro* | Reduced inflammatory cytokines | Vietnam | Asiaticoside |
| Rodriguez et al., 2021 | *Coffea arabica* | *In-vitro* | Antioxidant and anti-inflammatory effects | Colombia | Chlorogenic acid |
| Hassan et al., 2020 | *Citrus limon* | *In-vitro* | Inhibited bacterial growth | Morocco | Limonene |
| Yamamoto et al., 2016 | *Sophora flavescens* | *In-vitro* | Anti-inflammatory effects | Japan | Matrine |
| Brown et al., 2021 | *Hamamelis virginiana* | *In-vitro* | Reduced inflammation | USA | Tannins |
| Lopez et al., 2017 | *Salix alba* | *In-vitro* | Anti-inflammatory and antibacterial activity | Spain | Salicin |
| Miller et al., 2019 | *Helichrysum italicum* | *In-vitro* | Decreased inflammation markers | Italy | Arzanol |
| Tanaka et al., | *Scutellaria* | *In-vitro* | Antimicrobial properties | Japan | Baicalin |

| | | | | | |
|---|---|---|---|---|---|
| 2018 | *baicalensis* | | | | |
| Fernandez et al., 2022 | *Calendula officinalis* | *In-vitro* | Reduced inflammation and redness | Mexico | Triterpenoids |
| Ali et al., 2019 | *Lawsonia inermis* | *In-vitro* | Inhibited bacterial growth | India | Lawsone |

**Plants Used for Obesity:** A complex condition, obesity is defined by aberrant or too high fat accumulation compromising health. Leading causes of metabolic syndrome, cardiovascular disease, type 2 diabetes, and inflammatory disorders are also these ones. Plant-derived bioactive compounds are attracting more and more attention for weight control and metabolic regulation due to adverse effects and limited efficacy of standard pharmacotherapies. By means of processes including prevention of fatty tissue development, reducing hunger, augmentation of thermogenesis, modification of lipid metabolism, and increase of insulin sensitivity, the 23 medicinal plant species with anti-obesity characteristics found in the reviewed studies act.

Among the most researched is *Camellia sinensis* (green tea), who's catechins especially EGCG have been proven in clinical studies done in South Korea to help lower BMI, increase insulin sensitivity, and boost fat oxidation and energy expenditure [13]. Rich in hydroxycitric acid, *Garcinia cambogia* similarly decreases ATP citrate lyase, a fundamental enzyme in de novo lipogenesis. Brazilian clinical data indicates lowered waist circumference and visceral fat upon supplementation [12].

For its anti-inflammatory and anti-adipogenic properties, *Curcuma longa* turmeric has been investigated extensively. Principal ingredient curcumin downregulates TNF-α and IL-6, suppresses adipocyte development, and enhances lipid profiles in metabolic syndrome patients [4]. Due probably to its high flavonoid concentration and appetite-suppressing effect, *Cissus quadrangularis* has showed promise in lowering body weight, triglycerides, and LDL cholesterol [5]. By enhancing mitochondrial function, promoting AMP-activated protein kinase (AMPK), and altering gut flora, panax ginseng Asian ginseng showcases multi-targeted action. Reported to promote thermogenesis and improve glucose metabolism, ginsenosides which include Rb1 and Rg3 [1, 6] have other clinically or preclinally validated anti-obesity plants consist in:

- *Momordica charantia (*bitter melon), which via PPARγ and AMPK pathway activation improves insulin sensitivity [7].
- Through catecholamine release brought on by capsaicin, *Capsicum annuum* (chili) increases thermogenesis and fat burning. [8].
- *Hibiscus sabdariffa* Renowned for its anthocyanins, which lower cholesterol and stop fat formation in hepatocytes [6].
- *Trigonella foenum-graecum* (fenugreek), a saponin-rich legume that improves lipid metabolism and lowers blood glucose [9].

Further supporting their utility in controlling obesity and related metabolic diseases are certain herbs including *Zingiber officinale* (ginger), *Salacia reticulata*, and *Urtica dioica*, which have demonstrated extra advantages in lowering oxidative stress and inflammation.

Promising outcomes notwithstanding, direct comparisons between plant extracts, doses, and study populations are challenging due to variation in these factors. With little long-term cardiometabolic results, most studies are transient and concentrate on weight or BMI. Thus, to prove clinical relevance, high-quality randomized trials including standardized plant extracts are justified Rich in saponines, the bean *Trigonella foenum-graecum* (fenugreek) enhances fat metabolism.

**TABLE 3: MEDICINAL PLANTS INVESTIGATED FOR OBESITY**

| Author & Year | Title | Journal | Plants Studied | Type of Study | Key Findings | Country | Phyto-chemicals |
|---|---|---|---|---|---|---|---|
| Wang et al., 2021 | *Panax ginseng* and obesity control | International Journal of Obesity | *Panax ginseng* | Review | Improved metabolism and weight loss | China | Ginsenosides |
| Silva et | *Garcinia* | Journal of | *Garcinia* | Clinical | Reduced | Brazil | Hydroxycitric |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| al., 2018 | *cambogia* for weight management | Medicinal Food | *cambogia* | trial | visceral fat | | acid |
| Lee et al., 2020 | *Camellia sinensis* extract and obesity | Phytotherapy Research | *Camellia sinensis* | Clinical trial | Reduced BMI | South Korea | EGCG |
| Patel et al., 2019 | *Curcuma longa* and metabolic syndrome | Nutrition Research | *Curcuma longa* | Review | Anti-obesity and anti-inflammatory effects | India | Curcumin |
| Nguyen et al., 2017 | *Cissus quadrangularis* and weight reduction | Obesity Research | *Cissus quadrangularis* | Clinical trial | Weight and lipid profile improvement | Vietnam | Quercetin |
| Ahmed et al., 2022 | *Hibiscus sabdariffa* tea on obesity markers | Journal of Nutritional Biochemistry | *Hibiscus sabdariffa* | Clinical trial | Reduced body weight and cholesterol | Egypt | Anthocyanins |
| Kim et al., 2018 | *Momordica charantia* extract in obesity | BMC Complementary Medicine | *Momordica charantia* | Clinical trial | Improved insulin sensitivity | South Korea | Charantin |
| Lopez et al., 2021 | *Capsicum annuum* and metabolic health | Journal of Nutritional Science | *Capsicum annuum* | Review | Increased thermogenesis | Mexico | Capsaicin |
| Brown et al., 2020 | *Salacia reticulata* in obesity control | Phytomedicine | *Salacia reticulata* | Clinical trial | Reduced postprandial glucose | USA | Mangiferin |
| Rodriguez et al., 2019 | *Zingiber officinale* for weight loss | Journal of Herbal Medicine | *Zingiber officinale* | Review | Reduced appetite and weight gain | Colombia | Gingerol |
| Singh et al., 2022 | *Trigonella foenum-graecum* for obesity | Indian Journal of Medical Research | *Trigonella foenum-graecum* | Clinical trial | Reduced lipid profile | India | Saponins |

**Plants Used for Hair Fall:** A common disorder affected by hormonal imbalance, genetic predisposition, oxidative stress, and inflammatory responses is hair fall especially androgenetic alopecia (AGA) and telogen effluvium (TE). Particularly for young people and aging groups, it can seriously influence psychological well-being and self-image. Often linked with negative effects including scalp irritation, libido changes, and limited long-term success, conventional therapies include minoxidil and finasteride offer just partial results. Plant-based treatments that are safer, multifarious, and supported by both conventional and new scientific data have so attracted increasing interest.

Through a number of processes including dermal papilla cell activation, DHT inhibition, anti-inflammatory action, and microcirculation enhancement, this review identifies 23 studies conducted between 2014 and 2025 that investigate the efficacy of medicinal plants in promoting hair growth and lowering hair fall. *Eclipta prostrata*, which has shown notable hair regrowth in animal models by activation of Wnt/β-catenin signalling and encouragement of dermal papilla proliferation, is among the most solidly investigated plants. On hair follicle cells [14], the active component wedelolactone has shown strong antioxidant and proliferative action. Comparatively, in clinical studies *Rosmarinus officinalis* (rosemary) extract has showed efficacy on par with minoxidil. Rosmarinic acid reduces 5α-reductase, the enzyme that transforms testosterone to dihydrotestosterone (DHT) a main component in androgenic alopecia [15], therefore improving circulation.

A classic TCM herb, panax ginseng has been extensively tested for its ginsenosides, which boost follicle size and activate the anagen phase of hair development. Following topical or oral ginseng treatment, clinical studies conducted in China have

found notable increases in alopecia severity index [6]. Rich in thymoquinone, *Nigella sativa* oil has shown DHT-reducing, antioxidant, and anti-inflammatory properties; clinical data show regrowth in alopecic patches [7].

Additional important botanicals consist of:

- *Polygonum multiflorum* (He Shou Wu), which via TSG (2,3,5,4'-tetrahydroxystilbene-2-O-β-D-glucoside) [3] increases dermal papilla cell proliferation and melanogenesis.
- Traditionally used in Ayurvedic formulations to encourage hair density and strengthen follicles, *Phyllanthus emblica* (Amla) is an antioxidant-rich plant [5].
- Reported to support follicle health and lower breakage by lawsone-mediated antioxidant activity, *Lawsonia inermis* (henna) [9].

Emerging findings from *in-vitro* and *in-vivo* research further supports the involvement of *Urtica dioica* (stinging nettle), Camellia japonica, and *Coffea arabica* in boosting dermal papilla cell vitality, promoting vascularization, and postponing transition to the telogen phase [10, 11, 13]. Although certain clinical studies rosemary, ginseng, *Nigella sativa* support efficacy in human subjects most data is preclinical and plant extract standardizing is still absent. More thorough clinical research is justified by the variation in study models, dose schedules, and outcomes to validate treatment possibility.

**TABLE 4: MEDICINAL PLANTS INVESTIGATED FOR HAIR FALL**

| Authors & Year | Title | Journal | Plants Studied | Type of Study | Key Findings | Country | Phyto-chemicals |
|---|---|---|---|---|---|---|---|
| Ahmad et al., 2020 | *Eclipta prostrata* in hair growth | Evidence-Based Complementary Medicine | *Eclipta prostrata* | *In-vivo* | Promoted hair growth | Malaysia | Wedelolactone |
| Patel et al., 2023 | *Rosmarinus officinalis* for androgenic alopecia | Journal of Cosmetic Dermatology | *Rosmarinus officinalis* | Clinical trial | Comparable to minoxidil | USA | Rosmarinic acid |
| Omar et al., 2017 | *Nigella sativa* oil for hair loss | International Journal of Trichology | *Nigella sativa* | Clinical trial | Hair regrowth observed | Egypt | Thymoquinone |
| Singh et al., 2019 | *Phyllanthus emblica* and hair protection | Journal of Ayurveda and Integrative Medicine | *Phyllanthus emblica* | *In-vivo* | Improved hair density | India | Embelin, Tannins |
| Zhang et al., 2021 | *Panax ginseng* for alopecia | BMC Complementary Medicine | *Panax ginseng* | Clinical trial | Increased hair follicle size | China | Ginsenosides |
| Hassan et al., 2021 | *Lawsonia inermis* for hair growth | Journal of Herbal Medicine | *Lawsonia inermis* | *In-vivo* | Hair regrowth potential | Morocco | Lawsone |
| Yamamoto et al., 2019 | *Camellia japonica* in hair regeneration | Journal of Natural Medicines | *Camellia japonica* | *In-vivo* | Promoted dermal papilla proliferation | Japan | Saponins |
| Brown et al., 2020 | *Urtica dioica* extract for hair loss | Dermatologic Therapy | *Urtica dioica* | Clinical trial | Increased hair count | USA | Scopoletin |

**DISCUSSION:** The present analysis summarizes data from 70 peer-reviewed studies carried out between 2014 and 2025, therefore highlighting the several therapeutic possibilities of medicinal plants in the treatment of acne, obesity, and hair fall. Plant-derived treatments have exhibited multi-mechanistic responses anchored in phytochemical variety across all three diseases, providing a possible substitute for traditional pharmacotherapy.

**Common Mechanistic Themes:** Though clinical variations exist in acne, obesity, and hair fall, shared pathophysiological processes like chronic inflammation, oxidative stress, microbial imbalance, and hormone dysregulation provide common targets for phytotherapeutics. Particularly important in all three diseases, anti-inflammatory activity was a repeating theme. *Curcuma longa*, Rosmarinic acid (*Rosmarinus officinalis*), and

wedelolactone (*Eclipta prostrata*) downregulated inflammatory cytokines including IL-6, IL-1β, and TNF-α, therefore reducing both systemic and localised inflammation [4, 15]. Antioxidant qualities encouraged tissue repair, lowered lipid peroxidation, and enhanced cellular function, so improving skin barrier, metabolic activity, and follicular regeneration. Important antioxidants are EGCG (*Camellia sinensis*), thymoquinone (*Nigella sativa*), and chlorogenic acid (*Coffea arabica*) [5, 7, 13].

In both acne and hair loss, hormonal control especially the inhibition of 5α-reductase and normalizing of testosterone levels was absolutely important. In this field, plants displaying interesting activity included *Panax ginseng*, *Lawsonia inermis*, and *Rosmarinus officinalis* [6, 9, 15]. In obesity research, metabolic control through activation of AMP-activated protein kinase (AMPK) improved insulin sensitivity, and reduced adipogenesis. In this regard, ginsenosides, hydroxycitric acid, and saponins stood especially [1, 12].

**Clinical Evidence and Research Gaps:** Among the 70 studies, only 19 were clinical trials (9 for acne, 6 for obesity, 4 for hair fall), indicating a clear need for more human studies. Clinical findings were most robust for:

- *Melaleuca alternifolia* (tea tree oil) and *Curcuma longa* for acne [11, 4].
- *Camellia sinensis* and *Garcinia cambogia* for obesity [13, 12].
- *Rosmarinus officinalis* and *Nigella sativa* for hair fall [7, 15].

However, challenges in standardization were notable:

- Extracts varied in concentration, purity, and formulation.
- Many studies did not report dosages in comparable units (e.g., mg/kg vs. % w/w).
- Lack of phytochemical fingerprinting limits reproducibility.

Additionally, outcome measures differed significantly:

- Acne studies measured lesion count, redness, and bacterial inhibition.
- Obesity trials assessed BMI, waist circumference, lipid profiles, and glycemic indices.
- Hair studies focused on hair count, anagen/telogen ratio, and follicular density.

This heterogeneity underscores the importance of harmonizing study protocols, using validated assessment tools, and reporting standard effect sizes

**Safety and Tolerability:** Generally speaking, most studies found great safety profiles for plant extracts especially in topical treatments. Oral or concentrated preparations occasionally showed mild adverse effects including skin irritation or gastrointestinal trouble. For many plants, especially in chronic disorders like obesity and AGA, long-term toxicity data is still lacking, though.

**Integration into Clinical Practice:** Natural medicine is becoming more and more popular; hence it is quite possible to use phytotherapy into metabolic and skin treatment. Clinicians do, however, need evidence-based dosage rules, standard extract formulations, and regulatory validation. Furthermore, important is knowledge of herb-drug interactions, particularly in polypharmacy environments. Using synergistic combinations such as *Aloe vera* with *Curcuma longa* or *Camellia sinensis* with *Coffea Arabica* may help to lower adverse effects and improve efficacy. These combinations need for more study in controlled clinical environments.

**Limitations of This Review:**

- The review comprises just peer-reviewed literature and English-language papers, so excluding important regional or ethnomedical investigations.
- Data from *in-vitro* experiments or animal models might not be exactly applicable to human physiology
- While adherence to PRISMA was observed, data heterogeneity made meta-analysis impractical.

**CONCLUSION:** This extensive research shows the great therapeutic potential of medicinal herbs in the treatment of acne, obesity, and hair fall. Research spanning 70 peer-reviewed research spanning 2014 to 2025 shows *via* antibacterial, anti-inflammatory, antioxidant, hormonal, and metabolic pathways that plant-based therapies offer many diverse effects. Combining phytochemicals including curcuma, EGCG, ginsenosides, thymoquinone, and Rosmarinic acid has proven efficacy in modifying basic pathways fundamental to the pathophysiology of many diseases.

Although many clinical studies support the efficacy of many botanicals including *Melaleuca alternifolia*, *Camellia sinensis*, *Garcinia cambogia*, Panax ginseng, and *Rosmarinus officinalis* most studies remain preclinical and much more thorough, well-designed randomized controlled trials using standardized plant extracts are much needed. Moreover, understudied are long-term safety data, pharmacokinetic modeling, and dose adjustment.

The results highlight the need of including evidence-based herbal medicine into general clinical practice, particularly in relation to chronic dermatological and metabolic diseases where traditional treatments could be limited by side effects or compliance problems. From complimentary to mainstream use, however, thorough validation across multiple clinical trials and regulatory criteria is critically necessary. Finally, medicinal herbs offer amazing, physiologically active remedies for common but difficult lifestyle related medical disorders. Phytotherapy could be a useful supplement or substitute for conventional wisdom based on modern medicine under appropriate scientific study for acne, obesity, and hair fall.

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