Therapeutic Potential of a Polyherbal Hair Oil Formulation Incorporating Coconut, Pumpkin Seed, Hibiscus, Aloe Vera, Brahmi and Miracle Fruit

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***Abstract*—Hair and scalp disorders such as hair fall, dandruff, premature greying, and reduced hair density are multifactorial conditions influenced by oxidative stress, inflammation, microbial imbalance, nutritional deficiency, and psychological stress. Polyherbal formulations provide a rational therapeutic approach by targeting multiple pathological pathways simultaneously while maintaining a favorable safety profile. This review critically evaluates the pharmacological basis and therapeutic potential of a polyherbal hair oil formulation containing *Cocos nucifera* (coconut), *Cucurbita pepo* (pumpkin seed), *Hibiscus rosa-sinensis*, *Aloe vera*, *Bacopa monnieri* (brahmi), and *Synsepalum dulcificum* (miracle fruit). These botanicals are rich in bioactive compounds such as medium-chain fatty acids, flavonoids, saponins, polysaccharides, phytosterols, and antioxidants, which collectively promote hair growth, nourish the scalp, reduce inflammation, control microbial growth, and mitigate stress-related hair loss. The review integrates ethnomedicinal and experimental evidence to explain the complementary and synergistic mechanisms underlying their combined use. Although individual components demonstrate promising effects, formulation-based experimental and clinical validation remains necessary to establish efficacy and safety.**

***Keywords* — Polyherbal hair oil; Hair growth; Antioxidant activity; Herbal formulation; Scalp health**

I. INTRODUCTION

For centuries, plants have been a vital part of healing traditions around the world [1,2]. Even today, herbal medicine continues to gain importance as people seek natural, safe, and effective ways to maintain health and manage diseases [3]. Unlike single-ingredient synthetic drugs, herbal formulations often combine several plant extracts, allowing their natural compounds to work together in harmony [4]. This concept, known as polyherbalism, is based on the idea that the combination of herbs can enhance therapeutic effects and reduce possible side effects through a synergistic action [5,6].

In this review, we focus on a polyherbal blend made from Coconut (*Cocos nucifera*), Pumpkin Seeds (*Cucurbita pepo*), Hibiscus (*Hibiscus rosa-sinensis*), Aloe Vera (*Aloe barbadensis* Miller), Brahmi (*Bacopa monnieri*), and Miracle Fruit (*Synsepalum dulcificum*). Each of these natural ingredients has a long history of traditional use and is known for its rich profile of bioactive compounds. Coconut oil is valued for its nourishing, antimicrobial, and protective properties [7]. Pumpkin seeds are rich in zinc and essential fatty acids that support skin and hair health [8]. Hibiscus is widely recognized for promoting hair growth and possessing strong antioxidant activity [9]. Aloe vera soothes and hydrates the skin while aiding in wound healing and tissue repair [10]. Brahmi acts as a brain tonic, improving memory and reducing stress [11], while Miracle Fruit is rich in antioxidants that help combat oxidative stress and support metabolic balance [12].

II. PLANT PROFILE

2.1 COCONUT

- Synonyms – Copra oil
- Family – Palmae

- Biological source – fixed oil obtained by expression from thoroughly dried kernels of the cocus nucifera.

2.1.1 Macroscopical Evaluation:

Table No.1(Organoleptic Evaluation)

Color	it is white, semisolid fat.
Odor	Characteristic and Pleasent
Taste	bland and characteristic
Size	18-12 inches in length and 6-10 inches in diameter generally
Shape	Depends on its variety and maturity (oval or ovoid)
Cultivation Status	Extensively cultivated in tropical and domestic regions of world like India, Indonesia, Thailand, Malaysia

2.1.2 Taxonomical Classification:

Table No.2 (Taxonomical Evaluation)

Kingdom	Plantae
Subkingdom	Tracheobionta
Super division	Spermatophyte
Division	Magnoliophyta
Class	Liliopsida
Subclass	Monocots
Family	Asparagaceae
Sub family	Nolinoideae
Genus	Dracaena.
Species	*Dracaena reflexa Lam.*

2.1.3 Physical Classification:

Solubility – insoluble in water and alcohol. Soluble in chloroform either and carbon tetra chloride. It has lowest level of unsaturated fatty acids and hence costs of hydrogenation are very less

2.1.4 Chemical Classification:

Chemical Constituents –
Copra contains 65-68% fat, 15-20% carbohydrate, 9% proteins, 4- 9% crude fibers. Carbohydrate contain glucose, fructose, and raffinos.

2.1.4 Traditional use- – manufacturing of soap, edible fats, chocolate candies, In baking instead of lard, in candles, in ointment base in hair dressing in massage

2.2 HIBISCUS

- Synonyms – Rose mallow, Rose of Sharon and China rose.
- Biological source – it is obtained from the cultivated plants of Hibiscus rosa-sinensis Linn. Family – Malvaceae

2.2.1 Macroscopical Evaluation:

Table No.3 (Organoleptic Evaluation)

Color	Bright red also varities in pink, yellow and white
Odor	Characteristic, slightly, fragrant
Taste	Mucilaginous and slightly sweet
Size	5-15 cm in diameter and 6-10 cm in length
Shape	Large, showy and bell shaped
Cultivation Status	India, China, Sri Lanka, Indonesia

2.2.2 Taxonomical Classification:

Table No.4 (Taxonomical Evaluation)

Kingdom	Plantae
Subkingdom	Tracheobionta
Super division	Spermatophyta
Division	Magnoliophyta
Class	Magnoliopsida
Subclass	Dilleniidae
Family	Malavaceae
Sub family	Malvoideae

Genus	Hibiscuc
Species	*Hibiscus rosa – sinesis Linn.*

2.2.3 Physical classification:

Solubility – powdered drug is sparingly soluble in water, insoluble in alcohol, and organic solvents but mucilage swells in water form a viscous solution.

2.2.4 Chemical Classification:

Chemical Constituents – flavonoids (Hibiscetin, cyanidin derivatives), anthocyanins, mucilage, tannins and organic acids.

2.2.5 Traditional Use – As an demulcents, emollient, and hair growth promoter.

2.3 ALOEVERA

- Synonyms - Ghritkumari, Aloe barbadenis.
- Family – Liliaceae
- Biological source – It is obtained from the fresh or dried juice of the leaves of Aloe barbadensis Miller.

2.3.1 Macroscopical Evaluation:

Table No.5 (Organoleptic Evaluation)

Color	Greenish grey
Odor	Slightly unpleasant or bitter smell
Taste	Bitter
Size	60-100 cm
Shape	Leaves are tapering, thick and succulent
Cultivation Status	Prefer warm, dry climates and sandy soil like in India, Africa, Egypt, China

2.3.2 Taxonomical Classification
Table No.10 (Taxonomical Evaluation)

Physical classification:
Solubility – insoluble in water, soluble in alcohol, ether and chloroform.

2.3.3 Chemical Classification:
Chemical Constituents – Fixed oils 30-40% (glycerides of oleic, linoleic, palmitic and stearic acid), proteins (30%), phytosterols, Minerals and trace element, vitamins.

2.3.4 Traditional use: act as mild diuretic, show anthelmintic property, for skin and hair care [15].

2.4 BRAHMI

- Synonyms – Bacopa
- Family – Scrophulariaceae
- Biological source – it consists of the fresh leaves and the stems of the plants known as Bacopa moniera Linn.

2.4.1 Taxonomical Classification:

Table No. 6 (Taxonomical Evaluation)

Kingdom	Plantae
Subkingdom	Tracheobionta
Super division	Spermatophyta
Division	Magnoliophyta
Class	Magnoliopsida
Subclass	Asteridae
Family	Plantaginaceae
Species	*Bacopa monnieri Linn.*

2.4.2 Macroscopical Evaluation:

Table No.7 (Organoleptic Evaluation)

Color	Green
Odor	Slightly, characteristic
Taste	Bitter
Size	Small about 1-1.5 cm in diameter
Shape	Axillary, solitary
Cultivation Status	Grow in wet and marshy regions like India, Nepal, Sri Lanka

2.4.3 Physical classification:
Solubility – powdered drug is sparingly soluble in the water, insoluble in alcohol and ether, alcoholic extracts.

Chemical Classification:
2.4.4 Chemical Constituents – it consists alkaloids brahmine, herpestine, saponins, betulic acid, stigmasterol, monnierin and hersaponin.
2.4.5 Traditional Use – as nervine tonic, in the treatment of asthma, epilepsy and insanity, diuretic, also have anti-cancer property, also used in treatment of the dementia [16].

2.5 MIRACLE FRUIT

- Synonyms – Synsepalum dulcificum, miracle berry, sweet berry
- Family – sapotaceae
- Biological source – it consists of the fresh or dried berries obtained from the plant Synsepalum dulcificum.

2.5.1 Macroscopical Evaluation:

Table No.8 (Organoleptic Evaluation)

Color	Bright red (fresh fruit), pale yellow (dried)
Odor	Mild, faintly fruity
Taste	Slightly sweet
Size	2-3 cm
Shape	Oblong or ellipsoidal
Cultivation Status	In tropical and subtropical region like India, Japan, Florida, Taiwan

2.5.2 Taxonomical Classification:

Table No.9 (Taxonomical Evaluation)

Kingdom	Plantae
Subkingdom	Tracheobionta
Super division	Spermatophyta
Division	Magnoliophyta
Class	Magnoliopsida
Subclass	Asteridae
Family	Sapotaceae
Species	*Synsepalum dulcificum*

2.5.3 Physical classification:

Solubility – insoluble in water and most organic solvents.

2.5.4 Chemical Classification:
Chemical constituents – it consists of: -

- Miraculin
- Amino acids
- Ascorbic acid
- Phenolic compounds and flavonoids

2.5.5 Traditional use- use as sweeteners, appetite enhancer, treat gastro intestinal issues, as antioxidant, as preservative and flavor enhancer.

III. PHARMACOLOGICAL ACTIVITY OF POLYHERBAL

3.1 Coconut oil

a) Antimicrobial activity - Contain lauric acid, capric acid and monolaurin which show strong antibacterial, antifungal properties.

b) Antimicrobial activity - Topical or oral use of coconut oil help to reduce inflammation by decreasing pro-inflammatory mediators.

c) Antioxidant activity - Coconut oil is rich in polyphenols that neutralize free radicals and protect cells from oxidative stress

d) Skin and hair protective activity - Maintain skin hydration, act as an emollient and protects against UV damage, reduce hair loss.

e) Hypolipidemic activity – medium chain fatty acids (MFCAs) in coconut oil can increase HDL and improve lipid metabolism when used moderately.

f) Antidiabetic activity – MCFAs may enhance

insulin sensitivity and glucose metabolism thereby showing mild antidiabetic potential [18].

3.2 Hibiscus flower

a) Antioxidant activity – petals are rich in anthocyanins, flavonoids and vitamin C which scavenge free radicals.

b) Anti-inflammatory activity – extracts inhibits inflammatory mediators like prostaglandins and leukotrienes.

c) Antimicrobial activity – show antibacterial and antifungal action against E. coli, *staphylococcus aureus* and *candida albicans* due to polyphenolic compounds.

d) Hair-Growth-Promoting activity – hibiscus petals and leaves nourish hair roots, reduce hair fall and promote hair growth by improving scalp circulation and strengthening follicles.

e) Anti-ulcer and gastroprotective activity – mucilage content protects the gastric mucosa and reduces ulcer formation.

f) Wound-healing activity – mucilage and flavonoids stimulate collagen synthesis and tissue repair, helping in faster wound closure [19].

3.3 ALOEVERA

a) Wound-Healing Activity - Aloe vera gel promotes collagen synthesis, angiogenesis, and epithelial cell proliferation. Widely used in burns, cuts, and skin injuries for faster healing [20].

b) Anti-inflammatory Activity - Contains brady kininase, salicylic acid, and C-glucosyl chromone, which inhibit prostaglandin and histamine pathways [21].

c) Antimicrobial Activity - Exhibits antibacterial, antifungal, and antiviral properties due to anthraquinones (aloin, aloe-emodin) and saponins.

d) Skin & Hair Benefits - Used in cosmetics for moisturizing, anti-aging, and anti-acne properties. Promotes hair growth and reduces dandruff by nourishing the scalp.

e) Immunomodulatory Activity - Polysaccharides (especially acemannan) enhance macrophage activation and immune response.

f) Gastroprotective & Laxative Activity - The latex (yellow sap) contains aloin, which has a mild laxative effect. The gel also protects gastric mucosa, reducing ulcer formation [22].

3.4 Pumpkin seed oil

a) Anti-inflammatory activity – presence of linoleic and oleic acids helps reduce inflammation by inhibiting pro-inflammatory mediators like prostaglandins. Pumpkin seeds offer more healing and anti-inflammatory effects than pharmaceutical medications. Consumption of pumpkin seeds fared quite well in a comparative test between indomethacin, a typical arthritis medication, and the former. In fact, compared to indomethacin, pumpkin seeds had a better effect on the breakdown of the lipids in the joint linings

b) Antidiabetic activity – pumpkin seed extracts can improve insulin sensitivity and reduce blood sugar glucose levels due to their high magnesium and antioxidant content. Herbal preparations, which frequently contain pumpkin, are used to treat hyperglycemia in Mexico and China In-depth research has recently been done to examine the anti-diabetic properties of pumpkin flesh, seeds, and peel. According to this study, pumpkin powder trends to increase the body's production of insulin, which lowers glucose levels [23].

c) Antimicrobial activity – pumpkin seed oil shows inhibitory effects against certain bacteria and fungi, helping in the prevention of infections. The antibacterial components that have been identified from pumpkin seed oil are present in the oil from pumpkin seeds [24]. Additionally, phloem exudates from pumpkin seeds have been said to have anti-fungal effects and to suppress the pathogenic fungus [25].

d) Cardioprotective activity – unsaturated fatty acids and phytosterols in the oil help lower cholesterol and improve heart health. Mortality

from cardiovascular disease is inversely correlated with consuming foods high in tocopherols. Due to their abundance in unsaturated fatty acids, particularly-linoleic acid [26]. pumpkin seeds have been shown to have antiatherogenic properties [27]. According to Neferti.com, pumpkin seed oil makes blood vessel walls more elastic and sturdier, which aids in the treatment of atherosclerosis. Plant sterols and stools found in pumpkin seeds have been linked to atherosclerosis prevention [28].

3.5 Brahmi

a) Antioxidant Activity - Contains flavonoids and saponins that scavenge free radicals, protecting the brain and other organs from oxidative stress. Helps delay neurodegenerative conditions like Alzheimer's and Parkinson's diseases.

b) Anxiolytic and Antidepressant Activity - Brahmi reduces anxiety and stress by modulating serotonin and GABA levels in the brain.

c) Antimicrobial and Antipyretic Activity - Extracts show inhibitory effects against certain bacteria and fungi, and can help reduce fever [29].

d) Memory-Enhancing (Nootropic) Activity - Improves memory, learning ability, and concentration by enhancing synaptic transmission and increasing acetylcholine levels. Active compounds like bacosides A and B help repair damaged neurons and promote nerve impulse transmission [30]

3.6 MIRACLE FRUIT

a) Antioxidant Activity - Miracle fruit contains polyphenols, flavonoids, and vitamin C, which help neutralize free radicals. Protects cells from oxidative stress, aging, and chronic diseases [31].

b) Anticancer Activity - Antioxidant compounds in the fruit inhibit free-radical-induced DNA damage and suppress tumor cell growth in experimental studies.The miracle berry is also very nutritionally dense, containing high levels of health-promoting compounds, such as vitamins and essential minerals.In particular, the pulp and skin of the miracle berry contain high concentrations of phenolic compounds, such as flavonoids. This is especially relevant because many conventional cancer therapies, while effective against tumor cells, also induce substantial oxidative stress as part of their mechanism of action [32]

c) Antidiabetic Activity - The fruit helps regulate blood glucose levels by improving insulin sensitivity and reducing oxidative damage to pancreatic cells. The sweet protein miraculin modifies taste receptors, helping reduce sugar intake naturally [33].

d) Anticonvulsant-Activity- evaluated the anticonvulsant potential of *S. ducificum* seed aqueous fraction in mice subjected to pentylenetetrazole (PTZ)-, strychnine- and Maximal Electroshock (MES)-induced seizures. PTZ is a noncompetitive antagonist of gamma-aminobutyric acid type A (GABAA) receptor which binds to picrotoxin (PTX) site of the receptor. There was 33.33% defence against transience in PTZ- and strychnine-induced convulsion with significant reduction in the time of recovery from MES-induced seizure in animals pre-administered *S. ducificum* seed. According to the findings, specific phytochemicals in *S. dulcificum* seed extract possess anticonvulsant activity and the inhibitory neurotransmission was due to mild affinity for PTX binding site of the GABAA receptor [34].

IV. RESEARCH GAP AND FUTURE PROSPECTS

Despite extensive ethnomedicinal use and increasing experimental evidence supporting the pharmacological activities of coconut oil, pumpkin seed oil, hibiscus, aloe vera, brahmi, and miracle fruit, significant research gaps remain regarding their combined application as a polyherbal hair oil formulation. Most available studies focus on individual plant extracts or isolated bioactive constituents, while scientific validation of their synergistic interactions, optimal ratios, formulation stability, and bioavailability in a single formulation is limited. Standardized extraction methods, quality control parameters, and batch-to-batch consistency

have not been adequately established, which restricts reproducibility and clinical translation. Moreover, clinical studies evaluating the efficacy, safety, and long-term tolerability of such polyherbal hair oil formulations in human subjects are scarce, and mechanistic insights into molecular pathways involved in hair follicle stimulation, oxidative stress reduction, inflammatory modulation, and scalp microbiome regulation remain insufficient. Addressing these gaps, future research should prioritize formulation-based in vitro and in vivo studies to validate synergistic hair growth–promoting effects, followed by well-designed randomized clinical trials to establish therapeutic efficacy, optimal dosage, and long-term safety. Additionally, advanced phytochemical profiling, stability assessment, and molecular dermatological studies are required to elucidate mechanisms of action and ensure standardization, thereby supporting the development of this polyherbal hair oil as an evidence-based cosmetic or therapeutic intervention.

V. CONCLUSION

This blend of multiple herbs is based on both ethnomedicine and pharmacological justification, and as such, is more than an alternative to the synthetic agents - it embodies a synthesis of safety and efficacy, with holistic benefit. The therapeutic potential is not entirely based on anecdotal knowledge; more and more experimental research and clinical data are pointing to the requirement of multitarget interventions in the context of multifactorial health conditions.

People suffering with hair loss, skin pathology or chronic lifestyle conditions will not only find symptom relief in this formulation, but also potentially find general improvement across overarching health parameters such as antioxidant status, immunity, metabolic control and even cognitive function. Polyherbal formulations offer the benefits of lower toxicity and general overall benefit when compared to other approaches, due to their balancing and compensatory phytochemical matrix. Ultimately, the polyherbal approach is about more than natural medicine; it recognizes that intervention against complex health issues require comprehensive and multitarget interventions, where nature's diversity will take precedence in the management of human wellbeing.

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