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Formulation and Evaluation of Polyherbal Moringa Hair Oil

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Abstract: *Hair fall and dry, brittle hair are common scalp and cosmetic concerns linked to oxidative stress, inflammation, hormonal change, poor nutrition and environmental damage. Moringa oleifera contains flavonoids, phenolic compounds, tocopherols and fatty acids that show antioxidant and anti-inflammatory activity in laboratory studies. This paper reviews the literature on moringa in hair care and describes a polyherbal hair oil made by hot infusion of moringa, bhringraj, amla, hibiscus, fenugreek and rosemary powders in coconut and almond oil, with vitamin E added as an antioxidant. The oil was checked for appearance, homogeneity, grittiness, sedimentation, phase separation, spreadability and skin irritation. It was a uniform greenish-brown oil with a pleasant herbal odour, good spreadability and no irritation on patch testing. Claims of hair growth remain unproven and need clinical study.*

Keywords: Moringa oleifera, herbal hair oil, hair fall, oxidative stress, hot infusion, scalp health, polyherbal formulation..

I. INTRODUCTION

Hair is renewed through a repeating cycle with three stages: anagen, the active growth phase; catagen, a short phase of regression; and telogen, a resting phase after which the old hair is shed. When this cycle is disturbed by oxidative stress, inflammation, hormonal change, poor nutrition or environmental damage, the growth phase can shorten and more follicles enter rest early. Shedding then rises and the hair looks thinner [1]. Dry, brittle and frizzy hair is a related cosmetic problem and results mainly from loss of lipid and moisture from the hair shaft.

Moringa oleifera Lam. (family Moringaceae), known as the drumstick tree, is used widely in India as food and in traditional medicine. Its leaves contain flavonoids, phenolic acids, carotenoids, tocopherols, vitamins and minerals [2], [3], and extracts have shown antioxidant and anti-inflammatory effects in the laboratory. The seed oil is rich in oleic acid and is valued in cosmetics for its softening and skin-conditioning action [4], [5]. These properties make moringa a reasonable candidate for scalp and hair products. None of the cited work, however, shows that it treats hair loss in people.

Medicated hair oils are among the oldest herbal cosmetic forms in India. They are usually prepared by warming dried herbs in a vegetable oil so that oil-soluble constituents pass into it, and then filtering the oil. Popular articles describe moringa oil as useful for softness, shine and moisture retention, while admitting that proof of regrowth is limited [6]–[8]. Peer-reviewed polyherbal hair oil formulations follow the same basic approach [9], [10]. One point needs to be stated clearly. Most of the benefits quoted for moringa in cosmetic articles refer to the seed oil, whereas the oil prepared in this work is an infusion of moringa *leaf* powder in coconut and almond oil. The seed-oil literature is therefore used as background, not as direct support for the product.

The aim of this work was to formulate and evaluate a polyherbal hair oil containing moringa, bhringraj, amla, hibiscus, fenugreek and rosemary in a coconut and almond oil base, intended to moisturise the scalp and hair, strengthen the hair shaft and reduce breakage. The specific objectives were: (i) to prepare the oil by hot infusion; (ii) to check its physical

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properties, namely colour, odour, homogeneity, grittiness, sedimentation, phase separation and spreadability; (iii) to test it for skin irritation; and (iv) to review the literature that supports or limits the use of its ingredients.

Pathophysiology of hair fall

Reactive oxygen species damage lipids, proteins and DNA in follicular cells, set off inflammatory signalling, and can push follicles out of anagen into catagen or telogen ahead of time [1]. The result is a shorter growth phase, less hair produced and gradual thinning (Fig. 1). Constituents of moringa that act as antioxidants or reduce inflammation could, in principle, limit this damage around the follicle [2], [3]. This is a plausible mechanism and not a demonstrated one. Antioxidant activity in a test tube does not prove an effect on hair, and no controlled human trial of a moringa hair oil was found in the sources reviewed. A careful statement is that the oil may help protect scalp condition and reduce breakage, not that it prevents or reverses hair loss.

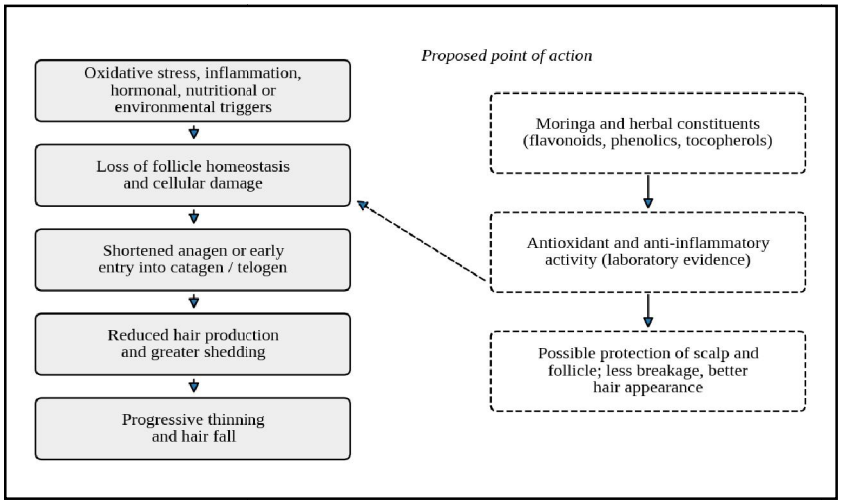


Fig. 1. Sequence of events in hair fall and the proposed point of action of moringa constituents

II. METHODOLOGY

Materials

The ingredients used in the formulation are listed in Table I. The herbs were used as dried powders. Equipment used was a weighing balance, a water bath and muslin cloth, together with common glassware (beaker, glass rod and measuring cylinder).

TABLE I: Ingredients and their role in the formulation

Ingredient	Botanical source / part	Role in the formulation
Coconut oil	*Cocos nucifera*, kernel	Base oil; conditioning
Almond oil	*Prunus dulcis*, seed	Carrier oil; emollient
Moringa powder	*Moringa oleifera*, leaf	Main herbal ingredient; flavonoids and phenolics
Amla powder	*Phyllanthus emblica*, fruit	Polyphenols and vitamin C; traditional hair-care use
Bhringraj powder	*Eclipta prostrata*, aerial part	Traditional hair-care herb
Hibiscus powder	*Hibiscus rosa-sinensis*, flower	Conditioning; anthocyanins and flavonoids
Fenugreek powder	*Trigonella foenum-graecum*, seed	Traditional hair-care use; saponins, mucilage
Rosemary powder	*Salvia rosmarinus*, leaf	Phenolic antioxidants (rosmarinic and carnosic acid)

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Vitamin E	α-Tocopherol	Antioxidant protecting the oils from rancidity

Preparation by hot infusion

The oil was prepared in the following steps.

1.The herbs were dried, powdered separately and passed through a sieve to give a fairly uniform particle size.

2.Weighed quantities of coconut oil and almond oil were mixed in a clean, dry stainless-steel vessel.

3.The herbal powders were added slowly to the oil with constant stirring so that they were evenly dispersed.

4.The mixture was heated on a water bath at about 60–70 °C for 30–60 minutes with occasional stirring, so that oil-soluble constituents could pass into the oil. This gentle heating follows published herbal hair-oil methods [9], [10].

5.Heating was stopped and the mixture was left to cool to room temperature.

6.The cooled mixture was filtered through muslin cloth to remove the herbal residue. A second filtration can be done for a clearer oil.

7.Vitamin E was added to the cooled filtrate and mixed well.

8.The finished oil was transferred to an amber-coloured container, closed tightly and kept in a cool place.

Evaluation parameters

The oil was evaluated for the following properties. *Organoleptic properties:* colour, appearance, odour and texture were noted by observation. *Homogeneity:* the oil was inspected for uniform mixing. *Grittiness:* the oil was examined for coarse herbal particles. *Sedimentation and phase separation:* the oil was left undisturbed in a transparent container and watched for settling of particles or formation of layers. *Spreadability:* the ease with which a small amount spread over a surface was assessed. *Skin irritation (patch test):* a small amount of oil was applied to a patch of skin on the hand and the site was observed for 24 hours for redness, swelling or itching. *Viscosity* by a suitable viscometer and *stability* under selected storage conditions are the recommended next tests for this type of product.

III. LITERATURE REVIEW

Table II summarises the main sources consulted. Review articles on the chemistry of moringa agree that the leaf is a rich source of phenolic and flavonoid compounds, carotenoids, vitamins and minerals [2], [3], [11]. Reviews of its cosmetic uses report that seed extract and seed oil have antioxidant, anti-inflammatory and skin-conditioning properties [4], [5]. The same reviews do not give enough clinical evidence to say that moringa promotes hair growth or treats alopecia. A review of oxidative stress in the follicle explains how excess reactive oxygen species disturb the hair cycle and discusses natural antioxidants as protective agents, but notes that antioxidant activity in the laboratory does not automatically carry over to patients [1].

TABLE II: Summary of selected literature

Ref.	Source type	What it reports	Limitation for this work
[2]	Review, 2016	Phenolics, flavonoids, vitamins and organic acids in moringa; antioxidant and anti-inflammatory activity	Not focused on hair
[3]	Review, 2017	Bioactive components of moringa leaf and their protective roles	No hair data
[4]	Review, 2024	Cosmetic uses of moringa, mainly seed oil	No clinical proof of hair growth
[1]	Review, 2024	Oxidative stress and the hair cycle; natural antioxidants	Laboratory-based
[5]	Review, 2024	Antioxidant and anti-inflammatory	Seed oil, not leaf

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		potential of moringa seed and seed oil	
[9], [10]	Formulation papers, 2021–2024	Preparation and evaluation of polyherbal hair oils	Small studies; limited testing
[6]–[8]	Consumer articles, 2019–2025	Use of moringa oil for softness, shine and moisture	Not peer reviewed

The other herbs in the formulation have a long traditional use in hair care, but the strength of evidence differs (Table III). The best human data are for rosemary. In one randomised comparative trial, rosemary oil and 2% minoxidil produced a similar increase in hair count in androgenetic alopecia after six months [14]. For the base oil, coconut oil has been reported to reduce protein loss from hair during washing and grooming [12], and in a trial on dry skin it moisturised about as well as mineral oil [13]. For amla, bhringraj, hibiscus and fenugreek, support in the sources reviewed comes mainly from traditional use and from laboratory or animal work.

TABLE III: Ingredients, reported constituents and strength of evidence for hair use

Ingredient	Reported constituents	Evidence for hair or scalp use
Moringa leaf	Quercetin, kaempferol, rutin, chlorogenic acid, carotenoids [2], [11]	Antioxidant activity in the laboratory; no hair trials
Amla	Gallic and ellagic acid, emblicanins, vitamin C	Antioxidant; traditional use
Bhringraj	Wedelolactone, luteolin, apigenin	Traditional use; some animal studies
Hibiscus	Anthocyanins, flavonoids, mucilage	Traditional conditioning use
Fenugreek	Saponins, diosgenin, trigonelline, galactomannan	Traditional use; laboratory data
Rosemary	Rosmarinic acid, carnosic acid, carnosol	One randomised trial of rosemary oil [14]
Coconut oil	Lauric acid (about 45–53%)	Reduces protein loss in hair [12]
Almond oil	Oleic and linoleic acid, tocopherols	Emollient; no hair-growth data
Vitamin E	α-Tocopherol	Protects oils from oxidation; little evidence alone

Advantages

Moringa oil is high in oleic acid and also contains behenic acid, which are emollient lipids. Such lipids can soften the hair cuticle and reduce moisture loss, which may be useful for dry or brittle hair [6], [7]. Antioxidants, including flavonoids and vitamins C and E, may help against the oxidative stress caused by pollution and sunlight, and the anti-inflammatory and antimicrobial activity reported for moringa suggests it could help to calm a mildly irritated scalp [5], [8]. The amino acids reported in moringa oil (arginine, cysteine and methionine) are also components of keratin, and this is sometimes offered as a reason why the oil may strengthen hair, though the point has not been tested for this product [6]. Finally, the oil is light for a plant oil and may add shine and reduce frizz without a heavy feel.

Limitations

Several limits should be kept in mind. Heavy oils can leave a greasy residue and may build up on the hair if over-applied, and they may not suit people with very oily or acne-prone scalps. Plant oils and herbal powders can cause irritation or allergic contact dermatitis in sensitive people, so a patch test before regular use is advisable. People with tree-nut allergy should avoid almond oil, and those with peanut or chickpea allergy should take care with fenugreek. Oils that contain unsaturated fatty acids can turn rancid when exposed to heat, light and air; vitamin E, amber containers and cool storage reduce this risk but do not remove it, and an oxidised oil is more likely to irritate. The oil is

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for external use only. Swallowing large amounts of moringa preparations can upset the stomach, so it should be kept away from children.

Beyond the product itself, the evidence base is thin. Most support for the herbs comes from traditional use and laboratory work, and the quality of herbal powders varies with species, season and handling. Standardisation of the plant material and a defined marker for each herb would make future batches easier to compare. Claims that the oil promotes hair growth, controls dandruff or reduces hair fall should be regarded as unproven until they are tested in controlled studies on volunteers.

IV. CONCLUSION

A polyherbal hair oil containing moringa leaf, bhringraj, amla, hibiscus, fenugreek and rosemary in a coconut and almond oil base was prepared by a simple hot infusion method. The product was homogeneous and free of grittiness, with good spreadability, a pleasant herbal odour, slight sedimentation and no irritation on patch testing. The literature gives a sound reason to expect conditioning and antioxidant benefits from the ingredients, but it does not show that moringa hair oil prevents hair loss or stimulates regrowth. The formulation is therefore best seen as a natural hair-care preparation. Quantitative evaluation, a full stability study, safety testing on more volunteers and controlled clinical studies are needed before any therapeutic claim is made.

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