

Formulation and Evaluation of Herbal Hair Oil Using Rosemary Leaves and Black Sesame Seeds

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Abstract: *The rising awareness regarding the adverse effects of synthetic chemicals used in cosmetic formulations has significantly increased the demand for natural, safe, and environmentally sustainable alternatives. Herbal products, particularly those derived from plant-based sources, are gaining widespread acceptance in the field of cosmetology due to their biocompatibility, minimal side effects, and therapeutic potential. Among these, herbal hair oils have emerged as an effective solution for maintaining scalp health and managing common hair-related problems such as hair fall, dandruff, dryness, and premature greying.*

*The present study was undertaken to formulate and evaluate a herbal hair oil using *Rosmarinus officinalis* (rosemary leaves) and *Sesamum indicum* (black sesame seeds), both of which are well recognized for their rich phytochemical composition and pharmacological properties. Rosemary contains bioactive compounds such as rosmarinic acid, camphor, and cineole, which exhibit antioxidant, antimicrobial, and anti-inflammatory activities. It is also known to enhance microcirculation in the scalp and stimulate hair follicles, thereby promoting hair growth..*

Keywords: Herbal hair oil, Rosemary, Black sesame, Polyherbal formulation, Hair growth, Natural cosmetics

I. INTRODUCTION

Hair is an essential component of human appearance and plays a crucial role in enhancing psychological confidence, self-esteem, and social identity. Healthy hair is often associated with overall well-being and vitality, whereas hair disorders can negatively affect an individual's quality of life. In recent years, there has been a noticeable rise in hair-related problems such as alopecia, dandruff, scalp irritation, dryness, thinning, and premature greying. These conditions are largely attributed to modern lifestyle factors including environmental pollution, exposure to ultraviolet radiation, stress, hormonal imbalances, poor dietary habits, and the excessive use of chemically formulated cosmetic products. Such factors disrupt the normal hair growth cycle, weaken hair follicles, and compromise scalp health, leading to progressive hair damage.

Conventional hair care products available in the market often contain synthetic chemicals such as sulfates, parabens, silicones, and artificial fragrances. While these substances may provide immediate cosmetic benefits such as smoothness and shine, their prolonged use has been associated with adverse effects including scalp irritation, allergic reactions, follicular damage, and long-term hair weakening. These concerns have led to a paradigm shift toward the use of herbal and plant-based formulations, which are perceived as safer, eco-friendly, biodegradable, and compatible with the human body. Herbal preparations have been utilized since ancient times in traditional systems of medicine for maintaining hair health and treating scalp disorders.

Among various herbal dosage forms, herbal hair oils have gained significant popularity due to their ease of application, ability to penetrate the scalp, and effectiveness in delivering bioactive phytoconstituents. These oils not only act as carriers but also enhance the absorption of active compounds into the hair follicles. Regular application of herbal oils



improves blood circulation in the scalp, provides essential nutrients, strengthens hair roots, and protects against environmental damage. Furthermore, herbal oils possess multiple pharmacological activities such as antioxidant, antimicrobial, anti-inflammatory, and moisturizing effects, which collectively contribute to improved hair growth and scalp condition.

Rosmarinus officinalis (rosemary), a member of the Lamiaceae family, is a well-known medicinal herb widely used in traditional and modern therapeutics. It is rich in phenolic compounds such as rosmarinic acid, carnosic acid, and flavonoids, along with volatile constituents like 1,8-cineole and camphor. These bioactive compounds exhibit potent antioxidant, anti-inflammatory, and antimicrobial activities, which help in reducing oxidative stress and maintaining scalp health. Rosemary is also known for its ability to stimulate microcirculation in the scalp, thereby enhancing the supply of oxygen and nutrients to hair follicles. This stimulation promotes hair growth, improves follicular strength, and may help in reducing androgen-related hair loss by influencing hormonal pathways.

Sesamum indicum (black sesame) is one of the oldest cultivated oilseed crops and is highly valued for its nutritional and medicinal properties. Black sesame seeds are a rich source of essential fatty acids such as linoleic acid and oleic acid, along with lignans like sesamin and sesamol, which possess strong antioxidant activity. In addition, they contain important vitamins (especially vitamin E and B-complex) and minerals such as calcium, iron, magnesium, and zinc, which are essential for maintaining healthy hair. The oil derived from black sesame seeds acts as a natural emollient, deeply nourishing the scalp, improving moisture retention, and preventing hair breakage. It also plays a role in protecting hair follicles from oxidative damage and may contribute to delaying premature greying by supporting melanin synthesis.

The combination of rosemary leaves and black sesame seeds in a single formulation offers a synergistic effect that enhances their individual therapeutic benefits. While rosemary primarily acts as a stimulant and protective agent by improving circulation and reducing inflammation, black sesame functions as a nourishing and conditioning agent that strengthens hair roots and improves hair texture. Together, these ingredients provide a comprehensive approach to hair care by addressing multiple underlying causes of hair disorders, including oxidative stress, microbial infections, nutrient deficiency, and poor scalp circulation.

Therefore, the present study aims to formulate and evaluate a herbal hair oil incorporating *Rosmarinus officinalis* and *Sesamum indicum*. The formulation is expected to serve as a natural, safe, and effective alternative to synthetic hair care products, offering benefits such as reduction in hair fall, promotion of hair growth, improvement in scalp health, and enhancement of overall hair quality.

II. MATERIALS AND METHODS

2.1 Materials

The plant materials used in the present study included *Rosmarinus officinalis* (rosemary leaves) and *Sesamum indicum* (black sesame seeds). These materials were procured from a local herbal market in good condition and were carefully selected to ensure authenticity and quality. The collected samples were free from visible contamination, fungal growth, and physical damage. Botanical identification of the plant materials was carried out using standard pharmacognostic characteristics to ensure their authenticity prior to use in formulation.

The carrier oils employed for the preparation of the herbal hair oil included coconut oil (*Cocos nucifera*) and almond oil (*Prunus amygdalus*). These oils were selected based on their excellent emollient properties, high fatty acid content, and their ability to act as effective vehicles for the extraction and delivery of bioactive phytoconstituents. Coconut oil is known for its antimicrobial activity and deep penetration into the hair shaft, while almond oil is rich in vitamin E and provides nourishment and conditioning to hair.

Vitamin E (α -tocopherol) was incorporated as a natural antioxidant to prevent oxidative degradation of the formulation and to enhance shelf life. Distilled water was used during the cleaning process of plant materials to remove dirt and impurities. All materials used in the study were of pharmaceutical or analytical grade and were used without further purification.



2.2 Preparation of Herbal Hair Oil

The herbal hair oil was prepared using the traditional infusion (heating) method, which is widely employed for extracting lipid-soluble phytoconstituents from plant materials into an oil base. This method ensures efficient transfer of active compounds while preserving their therapeutic properties when carried out under controlled conditions.

2.2.1 Collection and Processing of Plant Materials

Fresh rosemary leaves and black sesame seeds were thoroughly cleaned to remove dust, foreign particles, and other impurities. The plant materials were washed with distilled water and subsequently shade-dried at room temperature to avoid degradation of heat-sensitive phytoconstituents. Shade drying was preferred over sun drying to preserve the natural color, aroma, and chemical composition of the plant materials.

After complete drying, the materials were coarsely powdered using a mechanical grinder. The powdered form increases the surface area, thereby enhancing the extraction efficiency of bioactive constituents into the oil medium. The powders were stored in airtight containers to prevent moisture absorption and contamination prior to use.

2.2.2 Preparation of Oil Base

A suitable quantity of coconut oil and almond oil was taken in a clean, dry beaker to serve as the base for the formulation. The selection of a combination of carrier oils was intended to improve the overall therapeutic efficacy of the formulation, as both oils contribute unique beneficial properties such as moisturization, nourishment, and enhanced penetration into the scalp.

2.2.3 Infusion Process

The powdered rosemary leaves and black sesame seeds were accurately weighed and added to the oil base. The mixture was subjected to gentle heating at a controlled temperature range of 60–70°C for approximately 30–45 minutes. Continuous stirring was maintained throughout the heating process to ensure uniform mixing and to prevent localized overheating or degradation of active constituents.

The temperature was carefully controlled to avoid excessive heating, which could lead to the breakdown of thermolabile compounds such as essential oils and phenolic constituents. The infusion process facilitates the dissolution and transfer of lipid-soluble phytochemicals such as essential oils, fatty acids, and antioxidants into the carrier oil, thereby enriching the formulation.

2.2.4 Cooling and Filtration

After completion of the heating process, the mixture was allowed to cool gradually to room temperature. The cooled mixture was then filtered using muslin cloth or Whatman filter paper to remove solid residues and obtain a clear, homogenous oil extract. Filtration ensures the removal of particulate matter, thereby improving the aesthetic quality and stability of the final product.

2.2.5 Addition of Excipients

Vitamin E was added to the filtered oil as an antioxidant to prevent rancidity and oxidative degradation during storage. If required, a suitable preservative could also be incorporated to inhibit microbial growth and extend shelf life. The addition of excipients was carried out under hygienic conditions to maintain product quality.

2.2.6 Storage of Formulation

The final prepared herbal hair oil was transferred into clean, dry, and airtight amber-colored glass containers to protect it from light-induced degradation. The containers were properly labeled and stored in a cool and dry place away from direct sunlight. Proper storage conditions are essential to maintain the stability, efficacy, and shelf life of the formulation.



III. EVALUATION OF HERBAL HAIR OIL

The prepared herbal hair oil formulations were subjected to a series of physicochemical, organoleptic, and safety evaluation tests to determine their quality, stability, and suitability for topical application. These evaluation parameters are essential to ensure that the formulation meets the required standards for cosmetic use and provides effective performance without causing adverse effects.

3.1 Organoleptic Evaluation

Organoleptic evaluation is a preliminary yet important step in assessing the overall acceptability of a cosmetic formulation. In the present study, the prepared herbal hair oil formulations were evaluated for their color, odor, appearance, and texture using visual inspection and sensory perception methods.

The color of the formulations was observed against a white background to ensure uniformity and absence of any unwanted discoloration. Odor was assessed by smelling the sample to determine the presence of a characteristic and pleasant aroma, which is important for consumer acceptance. The appearance of the oil was examined for clarity, homogeneity, and absence of suspended particles or impurities. Texture was evaluated by rubbing a small quantity of oil between fingers to determine smoothness, greasiness, and consistency.

A good herbal hair oil formulation should possess a clear appearance, uniform color, pleasant odor, and smooth, non-gritty texture. These characteristics indicate proper extraction of phytoconstituents, adequate filtration, and overall quality of the formulation.

3.2 pH Determination

The pH of the herbal hair oil formulations was determined to assess their compatibility with the scalp. Maintaining an appropriate pH is crucial, as formulations with extreme pH values may cause irritation, dryness, or damage to the scalp and hair follicles.

For pH determination, a small quantity of the oil sample was diluted with distilled water to form a suitable emulsion. The pH was then measured using a calibrated digital pH meter. The electrode was immersed in the sample, and the reading was recorded once it stabilized.

An ideal herbal hair oil should have a pH range close to that of the scalp (approximately 5–7), which helps maintain the natural acid mantle of the skin. This ensures that the formulation is mild, non-irritating, and suitable for regular application.

3.3 Viscosity Measurement

Viscosity is an important parameter that determines the flow characteristics and consistency of the formulation. It directly influences the ease of application, spreadability, and consumer acceptability of the herbal hair oil.

In this study, viscosity was measured using a standard viscometer under controlled conditions. A specific volume of the oil sample was placed in the viscometer, and the resistance to flow was recorded. The measurements were taken at room temperature to maintain consistency.

An ideal viscosity ensures that the oil is neither too thick nor too runny. A moderately viscous formulation allows easy pouring, uniform spreading over the scalp, and better adherence to the hair surface. Excessively high viscosity may make application difficult, while very low viscosity may lead to poor retention on the scalp.

3.4 Spreadability Test

Spreadability is a critical parameter that determines how easily the formulation can be applied to the scalp and hair. Good spreadability ensures uniform distribution of the oil, which enhances its effectiveness and user experience.

The spreadability of the herbal hair oil was evaluated using a simple glass slide method. A fixed quantity of the oil sample was placed between two clean glass slides. A known weight was applied on the upper slide, and the time required for the slides to move apart was recorded. The ease with which the oil spreads indicate its spreadability.



Formulations with good spreadability require less effort during application and provide better coverage over the scalp surface. This property is influenced by factors such as viscosity, composition of carrier oils, and concentration of herbal ingredients.

3.5 Stability Study

Stability studies were conducted to evaluate the physical stability of the herbal hair oil under different environmental conditions. Stability is a crucial factor that determines the shelf life and effectiveness of the formulation over time.

The prepared formulations were stored at different temperature conditions, such as room temperature and elevated temperature, for a specified period. During the study, the samples were periodically observed for any changes in color, odor, consistency, phase separation, or formation of precipitates.

A stable formulation should retain its original physical characteristics without significant changes during storage. The absence of rancidity, phase separation, or degradation indicates good stability of the formulation. Stability studies also help in determining suitable storage conditions and packaging requirements.

3.6 Skin Irritation Test

The safety of the herbal hair oil for topical application was evaluated by performing a skin irritation test. This test is essential to ensure that the formulation does not cause any adverse reactions when applied to the skin.

A small quantity of the prepared oil was applied to a limited area of the skin, usually on the forearm or behind the ear. The application site was observed for a specific period for any signs of irritation such as redness, itching, swelling, or inflammation.

A formulation that does not produce any visible signs of irritation is considered safe for use. The absence of adverse reactions indicates that the herbal ingredients and excipients used in the formulation are non-toxic and suitable for regular application on the scalp.

IV. RESULTS

The formulated herbal hair oil containing *Rosmarinus officinalis* and *Sesamum indicum* was evaluated for various physicochemical, organoleptic, and safety parameters. The results obtained from the evaluation studies are presented below.

4.1 Organoleptic Properties

The organoleptic characteristics of the prepared formulations (F1, F2, and F3) were evaluated based on visual and sensory observations. The results are summarized in Table 1.

Table 1: Organoleptic Evaluation of Herbal Hair Oil

Sr. No.	Parameter	Observation
1	Color	Golden yellow to light amber
2	Odor	Pleasant, aromatic
3	Appearance	Clear and homogeneous
4	Texture	Smooth and light greasy

Result Interpretation

All formulations exhibited acceptable organoleptic properties with a clear and uniform appearance, indicating proper extraction and filtration. The pleasant aroma was mainly attributed to volatile constituents of rosemary, while the smooth texture confirmed good blending of carrier oils. These properties suggest that the formulation is suitable for cosmetic application and consumer acceptance.



4.2 pH Determination

The pH values of the different formulations were measured and are presented in Table 2.

Table 2: pH of Herbal Hair Oil Formulations

Sr. No.	Formulation	pH Value
1	F1	5.8
2	F2	6.1
3	F3	6.5



Fig no.6: pH test

Result Interpretation

The pH values of all formulations were found to be within the range of 5.8 to 6.5, which is close to the natural pH of the scalp. This indicates that the formulations are mild, non-irritating, and suitable for regular use without disturbing the scalp's natural acid mantle.

4.3 Viscosity Measurement

The viscosity of the formulations was determined to evaluate their consistency and flow behavior. The results are shown in Table 3.

Table 3: Viscosity of Herbal Hair Oil

Sr. No.	Formulation	Viscosity (cP)
1	F1	120
2	F2	150
3	F3	180



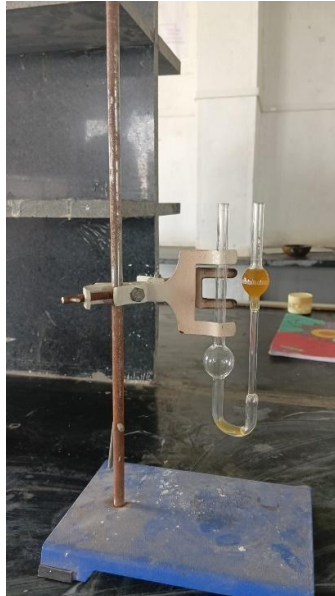


Fig no.7 Viscosity test

Result Interpretation

The viscosity of the formulations increased with an increase in the concentration of herbal components. F1 showed the lowest viscosity, while F3 exhibited the highest. Among all, F2 demonstrated optimum viscosity, ensuring ease of application along with good adherence to the scalp.

4.4 Spreadability

The spreadability of the formulations was evaluated and the results are presented in Table 4.

Table 4: Spreadability of Herbal Hair Oil

Sr. No.	Formulation	Spreadability
1	F1	Good
2	F2	Excellent
3	F3	Good



Figno.8: Spreadability test



Result Interpretation

All formulations showed satisfactory spreadability; however, formulation F2 exhibited excellent spreading ability. This indicates that F2 can be easily applied and distributed uniformly on the scalp, enhancing its usability and effectiveness.

4.5 Stability Study

The formulations were subjected to stability studies under different storage conditions. Observations revealed no significant changes in physical parameters.

Observations:

- No change in color
- No development of unpleasant odor
- No phase separation
- No change in consistency

Result Interpretation

The absence of physical changes during storage indicates that the formulations are stable. The addition of vitamin E as an antioxidant contributed to preventing oxidation and rancidity, thereby enhancing shelf life.

4.6 Skin Irritation Test

The safety of the herbal hair oil was evaluated through a skin irritation test.

V. DISCUSSION

The present study successfully demonstrated the formulation and evaluation of a polyherbal hair oil incorporating *Rosmarinus officinalis* and *Sesamum indicum*. The results obtained from various physicochemical, organoleptic, and safety evaluations indicate that the developed formulations possess desirable characteristics suitable for cosmetic and therapeutic applications.

The organoleptic evaluation revealed that all formulations exhibited a clear appearance, pleasant aroma, and smooth texture, which are essential attributes for consumer acceptability. The absence of turbidity or particulate matter indicates effective filtration and uniform distribution of herbal constituents within the oil base. The characteristic aromatic odor can be attributed to the presence of volatile compounds such as 1,8-cineole and camphor present in rosemary, which also contribute to its therapeutic properties.

The pH of the formulations was found to be within the range of 5.8 to 6.5, which is considered suitable for scalp application. Maintaining a pH close to that of the natural scalp environment is crucial, as it helps preserve the acid mantle, prevents microbial growth, and reduces the risk of irritation or dryness. The results suggest that the formulated oil is mild and compatible with regular use without causing disruption to the scalp's physiological balance.

Viscosity plays a vital role in determining the application characteristics of hair oil. In the present study, the viscosity values ranged from 120 to 180 cP, indicating that the formulations possessed appropriate consistency. The gradual increase in viscosity with higher concentrations of herbal components suggests effective incorporation of plant materials into the oil base. An optimum viscosity, as observed in formulation F2, ensures ease of application, better adherence to the scalp, and improved retention time, thereby enhancing the overall effectiveness of the formulation.

Spreadability is another important parameter that influences user convenience and uniform distribution of the formulation. All formulations demonstrated satisfactory spreadability, with F2 showing excellent performance. This indicates that the oil can be easily applied and evenly distributed over the scalp surface, allowing better penetration of active constituents into hair follicles. The enhanced spreadability of F2 may be attributed to the balanced ratio of carrier oils and herbal extracts, which optimized the rheological properties of the formulation.



The stability studies confirmed that the formulations remained physically stable under different storage conditions, with no significant changes in color, odor, or consistency. The absence of phase separation and rancidity indicates that the formulation is chemically stable and resistant to degradation. The incorporation of vitamin E as an antioxidant played a significant role in preventing oxidative deterioration of the oil, thereby improving its shelf life and maintaining its efficacy over time.

The safety profile of the formulation was confirmed through the skin irritation test, which showed no signs of redness, itching, or inflammation. This indicates that the formulation is non-toxic, non-irritant, and safe for topical application. The use of natural ingredients further enhances its safety, making it suitable for long-term use compared to synthetic formulations that may cause adverse effects.

The therapeutic effectiveness of the formulation can be attributed to the bioactive phytoconstituents present in rosemary and black sesame. Rosemary contains phenolic compounds such as rosmarinic acid and carnosic acid, which exhibit strong antioxidant and anti-inflammatory properties. These compounds help in reducing oxidative stress, improving microcirculation, and stimulating hair follicles, thereby promoting hair growth. Additionally, rosemary may help in inhibiting dihydrotestosterone (DHT), a hormone associated with hair loss, thus contributing to the prevention of androgenic alopecia.

Black sesame seeds are rich in essential fatty acids, lignans (sesamin, sesamol), vitamins, and minerals, which provide deep nourishment to the scalp and strengthen hair roots. The antioxidant properties of sesame help protect hair follicles from free radical damage, while its emollient nature improves moisture retention, reduces dryness, and enhances hair texture. Furthermore, sesame oil may contribute to melanin production, thereby helping to delay premature greying.

The combination of rosemary and black sesame in the formulation results in a synergistic effect, where rosemary acts as a stimulant and protective agent, while sesame serves as a nourishing and conditioning agent. This dual mechanism addresses multiple factors responsible for hair damage, including oxidative stress, poor circulation, nutrient deficiency, and microbial infection.

Among the three formulations, F2 exhibited the most optimal characteristics in terms of viscosity, spreadability, and overall performance. This suggests that a balanced concentration of herbal ingredients is essential to achieve maximum efficacy without compromising physical stability and user acceptability. Excessive concentration may increase viscosity and reduce spreadability, while insufficient concentration may reduce therapeutic effectiveness.

Overall, the findings of this study support the potential of the formulated herbal hair oil as an effective natural alternative to conventional synthetic products. The formulation not only meets the required physicochemical and safety parameters but also offers multiple therapeutic benefits for maintaining scalp health and promoting hair growth. Further studies, including in vivo and clinical evaluations, are recommended to validate its efficacy on a larger scale and to explore its potential for commercial development.

VI. CONCLUSION

The present study successfully developed and evaluated a polyherbal hair oil formulated with *Rosmarinus officinalis* and *Sesamum indicum*, demonstrating favorable physicochemical properties, stability, and safety for topical application. The formulation exhibited suitable pH, optimal viscosity, good spreadability, and absence of skin irritation, indicating its compatibility with scalp conditions and ease of use. The presence of bioactive phytoconstituents such as phenolics, lignans, essential fatty acids, and antioxidants contributes to its therapeutic potential by enhancing scalp nourishment, improving blood circulation, reducing oxidative stress, and strengthening hair follicles. These combined effects suggest that the formulated herbal oil can effectively support hair growth, minimize hair fall, and improve overall hair quality. Furthermore, the study highlights the potential of herbal formulations as safe and sustainable alternatives to conventional synthetic products. However, additional in vivo and clinical studies are necessary to further validate its efficacy, establish long-term safety, and support its potential for large-scale commercialization.



REFERENCES

- [1]. Evans WC. *Trease and Evans pharmacognosy*. 16th ed. London: Saunders Elsevier; 2009.
- [2]. Kokate CK, Purohit AP, Gokhale SB. *Pharmacognosy*. 55th ed. Pune: Nirali Prakashan; 2016.
- [3]. Khandelwal KR. *Practical pharmacognosy*. 23rd ed. Pune: Nirali Prakashan; 2015.
- [4]. Harborne JB. *Phytochemical methods: A guide to modern techniques of plant analysis*. 3rd ed. New York: Springer; 2005.
- [5]. Wallis TE. *Textbook of pharmacognosy*. 5th ed. New Delhi: CBS Publishers; 2002.
- [6]. Chattopadhyay RR. Herbal cosmetics and cosmeceuticals: An overview. *Int J Pharm Sci Rev Res*. 2012;12(1):1–5.
- [7]. Kapoor VP. Herbal cosmetics for skin and hair care. *Nat Prod Radiance*. 2005;4(4):306–314.
- [8]. Pandey MM, Rastogi S, Rawat AKS. Indian herbal drugs for general healthcare: An overview. *J Ethnopharmacol*. 2013;146(3):1–15.
- [9]. Draelos ZD. Hair cosmetics: An overview. *Dermatol Clin*. 2000;18(4):651–667.
- [10]. Trüeb RM. Oxidative stress in ageing of hair. *Int J Trichology*. 2009;1(1):6–14.
- [11]. Dhurat R, Chitallia J, May TW, et al. A randomized comparative trial of rosemary oil versus minoxidil for androgenetic alopecia. *Skinmed*. 2015;13(1):15–21.
- [12]. Bhatia SC. *Perfume, soaps and cosmetics*. New Delhi: CBS Publishers; 2001.
- [13]. Ali B, Al-Wabel NA, Shams S, et al. Essential oils used in aromatherapy: A systemic review. *Asian Pac J Trop Biomed*. 2015;5(8):601–611.
- [14]. Shah G, Shri R, Panchal V, et al. Scientific basis of herbal medicines. *Asian Pac J Trop Biomed*. 2010;3(2):89–95.
- [15]. Rathi V, Rathi JC, Tamizharasi S. Evaluation of herbal hair oil formulations. *Int J PharmTech Res*. 2011;3(3):1525–1529.
- [16]. Singh A, Duggal S, Singh J, et al. Herbal cosmetics: A review. *Int J Cosmet Sci*. 2010;32(5):1–9.
- [17]. Banchhor M, Ashawat MS, Saraf S. Herbal cosmetics: Trends in skin care formulation. *Int J Pharm Sci Rev Res*. 2009;5(2):1–7.
- [18]. Lin TK, Zhong L, Santiago JL. Anti-inflammatory and skin barrier repair effects of topical coconut oil. *J Tradit Complement Med*. 2017;8(1):5–14.
- [19]. Elleuch M, Besbes S, Roiseux O, et al. Quality characteristics of sesame seeds and by-products. *Food Chem*. 2007;103(2):641–650.
- [20]. Namiki M. Nutraceutical functions of sesame: A review. *Crit Rev Food Sci Nutr*. 2007;47(7):651–673.
- [21]. Hwang JH. Antioxidant activity of sesame oil. *J Food Sci*. 2005;70(2):1–5.
- [22]. Takahashi M, et al. Hair growth-promoting activity of plant extracts. *J Dermatol Sci*. 2012;65(1):1–10.
- [23]. Dweck AC. Natural ingredients for hair care. *Int J Cosmet Sci*. 2002;24(5):287–302.
- [24]. Rastogi RP, Mehrotra BN. *Compendium of Indian medicinal plants*. New Delhi: CDRI; 1993.
- [25]. Khare CP. *Indian medicinal plants: An illustrated dictionary*. New York: Springer; 2007.
- [26]. Upton R. *Rosemary leaf monograph*. American Herbal Pharmacopoeia; 2001.
- [27]. McGee H. *On food and cooking: The science of sesame*. New York: Scribner; 2004.
- [28]. Baumann L. *Cosmetic dermatology: Principles and practice*. New York: McGraw-Hill; 2009.
- [29]. Harry RG. *Harry's cosmetology*. 8th ed. New York: Chemical Publishing Co.; 2000.
- [30]. Lachman L, Lieberman HA, Kanig JL. *The theory and practice of industrial pharmacy*. 3rd ed. Mumbai: Varghese Publishing; 2009.

