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Review Article

Formulation and evaluation of herbal hair serum-a review

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ABSTRACT

In the mammalian system the hair follicle is known to the most significant organ that determine, appearance, gender distinction, provides intense temperature protection and plays a role in self-defence. The younger generations have begun to suffer extreme hair loss problem due to many reasons. The hair loss is not temporary in most cases. but it results in alopecia. Many people suffering from hair loss is in search of multiple treatments due to extreme anxiety and tension. To improve hair growth and to prevent hair loss, hair root activation is required. *Citrus sinensis* is used to antidandruff protection hair care. It's had antibacterial and anti-inflammatory properties. *Nigella sativa* improves the shine, strength, volume, and texture of hair. Flax seed is full of fatty acids and antioxidants that tend to remove pollutants and dead cells from the scalp. Coconut oil may help to moisturise and seal hair. They can help to prevent dry, flaky scalp and dandruff. This review article focuses on the materials required for the formulation of hair serum and various evaluation tests to evaluate hair serum.

Keywords: Hair, Hair growth, Alopecia, Cosmetics, Herbs

INTRODUCTION

Hair is an integrated framework with a unique chemical and physical behaviour.[1] It is a thin flexible keratin thread with extraordinary strength and elasticity.[2] Hair care products are used to improve its appearance, and it is a cyclical medium involving hair shaft conflation, extension, and shedding.[3] Hair is formed of follicles of anagen, catagen, and telogen phases, with a root, shaft, and tip.[4] Cosmetics are available to assist extend growth and stop hair loss because ageing causes hair to turn white.[5] Since it includes significant knowledge and a wide range of data from numerous other scientific fields, cosmetic science is a legitimate science and a multidisciplinary field. Development, formulation, and production of cosmetics and personal care items are all part of its scope.[6] Cosmeceuticals are one of a kind and swiftly developing field inside dermatology and healthy skin industry.[7]

"Natural cosmetics or herbal cosmetics" refers to products that are made with a base of diverse legal cosmetic ingredients and one or more herbal ingredients that are utilised solely to deliver specified cosmetic benefits.[8] Herbal cosmetic products are preparation containing phytochemical from different botanical sources.[9] Study objective was to understand characteristics of risk factors to avoid using synthetic products containing local herbs before and after trial, and to study satisfaction of users with hair serum products containing local herbal ingredients.[10]

Advantages

Hair serum adds natural shine while shielding hair from environmental or heat-related damage with its rich moisturising characteristics. Hair is known to become healthier and less brittle by being moisturised and locked in moisture by serums, which also make it feel smoother and appear healthier.[11] Hair serum's anti-frizz properties also aid to increase its smoothness.[12]

Disadvantages

Constant use and excessive application might damage hair. After using it consistently for a few days, this builds up

and weighs down hair, giving it very flat and lifeless appearance.[11] Using serum on scalp can cause inflammation.[13]

METHODS AND MATERIALS

Zingiber officinale (ginger)

One of the most popular spices in world is ginger, which is root of plant *Zingiber officinale* (L.) Rosc. Numerous active ingredients are included-gingerol, shogaol, zingerone and bisabolene.[14] Utilised as folk remedy for variety of illnesses including rheumatoid arthritis, neurodegenerative diseases, inflammation and asthma.[15] Many of its active constituents have anti-diabetes, anti-cancer and anti-inflammatory activities, in addition to powerful antioxidant activity and decrease of many pro-inflammatory biomarker.[16,17] Ginger can be effective in treatment of AA. Meanwhile, these constituents are safe and convenient, these features can improve compliance of patients with AA during treatment.[18]

Figure 1: *Zingiber officinale.*

Citrus sinesis (orange)

Citrus peel is rich in many nutrients, as vit C, carotene, and protein. Orange peel can infuse hair growth with necessary nutrients, refine damaged hair, and enhance toughness of hair. Furthermore, it can promote blood circulation in skin, induce metabolism, nourish the scalp, and induce hair growth in good environment. Secondary metabolites found in abundance in *Citrus sinensis* contribute to medicinal properties attributed to this plant. Antimicrobial potency of plants is believed to be due to tannins, saponins, phenolic compounds, essential oils, and flavonoids.[22,21]

Figure 2: *Citrus sinensis.*

Linum usitatissimum (flaxseeds)

Due to its high concentrations of -linolic acid (ALA, an omega-3 fatty acid), lignans, and fibre, flaxseed, also known as linseed, is becoming a vital functional food element.[22] A reduction in cardiovascular disease, atherosclerosis, diabetes, cancer, arthritis, osteoporosis, autoimmune and neurological disorders is one potential health advantage of flaxseed oil, fibres, and lignans. In addition, flaxseed is a rich source of antioxidants and fatty acids, which help to cleanse the scalp of toxins and skin cells that are dead. Applying flax seed gel to the scalp and hair as a moisturizer can promote hair development and strengthen existing hair.[24] Flaxseed extract hydrates and maintains the suppleness of the skin. Its suitable for all skin types (normal, dry, and oily). Flax seed oil moisturises damaged hair, soothes sensitive scalps, and gives limp, lifeless hair volume.[25]

Figure 3: *Linum usitatissimum*.

Nigella sativa (Black seed)

Nigella sativa L. belongs to the buttercup family *Ranunculaceae*. It is classified as a mild spice based on plants parts used. 'Black seed' is the popular name for *Nigella sativa*. *N. sativa* seed and its oil has been widely used for centuries in the treatment of various ailments throughout the world and it is an important in the Indian traditional system of medicine like Unani and Ayurveda.[26] It contains many bioactive constituents like thymoquinone, thymohydroquninone, dithymoquinone, thymol, carvacrol, nigellimine, nigellisin and alphaahederin etc. *Nigella sativa* gives pharmacology and cosmetic properties both like antioxidant, antimicrobial, anti-inflammatory, astringent, stimulant, diuretic, etc.[27-28] *Nigella sativa* seed oil has best the natural ingredients for mouth wash and toothpaste and also it could be the best constituent for treating various fungal and bacterial infections like dandruff, acne, pimples, and other skin conditions in antidandruff shampoo, anti-acne cream hand wash and skin clarifying cream. *Nigella sativa* can act as best candidate for natural hair growth promoter.[29]

Figure 4: ***Nigella sativa.***

Trigonella foenum graceum (Fenugreek)

Fenugreek seed extract is a nutritional supplement that also contains micronutrients like B-vitamins, antioxidants, and trace elements found in hair. *Trigonella foenum-graceum* L. (fenugreek) is a leguminous herb. Fenugreek is indigenous to Southern Europe, Western Asia, and the Mediterranean. Saponins, including diosgenin, yamogenin, and gitogenin derivatives, trigonelline alkaloids, flavonoids, galactomannan vitamins, and fibre, among other active components, are found in fenugreek seeds.[30] The seeds have a pleasant aroma and a tart taste.

Fenugreek is recognised to promote healthy hair development, although the exact mechanism has not been identified. It is suggested that fenugreek increases the blood flow to hair follicles and steroid saponins, which interact physiologically with the formation of DHT (dihydrotestosterone). One possible cause of both male and female variant hair loss is the effect of DHT on genetically predisposed hair follicles. The increasing miniaturisation of the hair and eventual hair loss are caused by binding DHT to the hair follicle.[31,32]

Figure 5: ***Trigonella foenum graceum*.**

Cocos nucifera (Coconut oil)

Coconut oil is one of the best organic nutrients for hair. It contributes to the lustrous, healthy growth of hair. It is also quite efficient at preventing protein loss, which can cause your hair to grow in various unsightly or unhealthy ways. In the Indian subcontinent, coconut oil is widely used for hair treatment. After taking a shower or bath, the majority of individuals in those nations apply coconut oil to their hair every day. It is a great conditioner and aids in the process of damaged hair growing back. Additionally, it offers the crucial proteins needed for nourishing and repairing harmed hair. According to studies, coconut oil offers hair stronger defence against fatigue-related hair damage. Coconut oil massages on a regular basis can help.[33]

Figure 6: ***Cocus nucifera.***

***Prunus dulcis (Almond oil*)**

Applying almond oil deeply hydrates the scalp and fortifies the hair follicles, resulting in thick, lustrous, and beautiful hair. Almond oil might assist you in getting rid of dandruff. It has anti-bacterial characteristics that heal dry skin and exfoliate the scalp of dead skin cells. It is a vitamin B derivative that is recommended to persons who have issues like hair thinning. Almond oil includes biotin, so massaging your hair with it is a good way to give it a healthy dose of the vitamin to encourage hair development and stop hair thinning. According to studies, using almond oil topically can help prevent sun-induced skin damage and reduce the ageing process. Almond oil can assist with cellular protection by reducing DNA damage from UV rays and prevent the chemical and structural changes they can make.[34]

Figure 7: ***Prunus dulcis.***

Tocopherol (Vitamin E)

A vitamin E-rich oil can help to restore shine by rebuilding the protective layer. In general, oil helps to seal in moisture, minimise breakage, and protect the hair from harm.[35] Vitamin E may help support a healthy crown and hair since it contains natural antioxidants that may aid in hair growth. Vitamins and antioxidants can reduce the quantity of oxidative stress and free radicals that lead to the deterioration of the hair follicle cells in one's crown.

Figure 8: Tocopherol.

FORMULATION

Formulation 1

All fresh sauces such as citrus sinesis peel, *Zingiber officinale* roots, *Linum usitatissimum* seeds, as well as *Nigella sativa* seeds, *Trigonella foenum graceum* seeds were specially counted and distributed in 50 ml of water. The contents which refer to more, are boiled for 15 minutes. Allow them to cool after 15 minutes of boiling and filter.

Coconut oil, almond oil and vitamin E were added to the filter. After that, the set of serum was stored in a nebulizer.[36]

Formulation 2

Medicinal plant serum for the hair is prepared according to the general method of serum preparation. In this composition, the aqueous extract *Nigella sativa* seeds, *Zingiber officinale* roots, *Linum usitatissimum* seeds and *Trigonella foenum graceum* seeds were specially weighed and poured into a glass. Where citrus sinensis peel and above extract were mixed thoroughly. The required amount of coconut oil with above extraction was taken in a porcelain dish and mixed well until a paste was obtained. About 3 drops of essential oils such as coconut oil, almond oil and vitamin E capsule were added and mixed together. The porcelain mixture was added to the extract with constant stirring. The serum is brought up to 50 ml with distilled water. Rosemary extract is added as a preservative. The prepared serum was then stored in a amber dropper bottle.[37]

Formulation 3

Pour coconut oil, almond oil, and vitamin E into a bowl. Add *Nigella sativa* seeds, *Zingiber officinale* roots, *Linum usitatissimum* seeds, *Trigonella foenum graceum* and *Citrus sinensis* peel extract, mix well and heat, pour the solution into a container and cool it in water bath. Transfer the solution to a spray bottle and refrigerate for 24 hours.[38]

Formulation 4

Clean glassware and dry it properly as per SOP. Measure the exact number of extracts of nigella sativa seeds, *Zingiber officinale* roots, *Linum* usitatissimum seeds, *Trigonella foenum graceum* transfer it to a glass. Mix the required amount of vitamin E into the citrus sinensis peel. Now mix the coconut oil and almond oil with the above citrus sinensis peel and vitamin E mixture. After stirring for a few minutes heat, the prepared solution for few minutes. After that, mix the preparation with a magnetic stirrer. Transfer the serum to a measuring cylinder and bring the final volume to 50 ml. Transfer the final solution to a container.[39]

Table 1: Formulation table.

Ingredients	Quantity (%)	Role
Flaxseed	10	**Emollient**
Ginger	20	**Antioxidant**
Nigella sativa	10	**Natural DHT blocker**
Fenugreek	10	**Emulsifying agent**
Orange peel	8	**Antidandruff**
Coconut oil	30	**Detangles hair**
Almond oil	10	**Hair growth**
Vitamin E	2	**Healthy scalp**

EVALUATION OF HERBAL HAIR SERUM

Physical appearance

Visual inspection is done to determine the herbal hair serum's physical characteristics, colour, and texture.[40]

Homogeneity test

The hair serum was applied to a dry, clean object glass, and then a cover glass was fixed over it. Investigated was the appearance in the presence of certain coarse particles or homogeneity. The homogeneity and presence of lumps, flocculates, or aggregates in a herbal hair serum were checked visually.[41]

pH test

Using buffer solutions with a pH of 4 and 7, the pH metre was calibrated. After a few minutes, the electrode was left to soak in the hair serum until the pH returned to normal.[42]

Viscosity

On a Brookfield viscometer (RVDV-II+PRO), spindle number 6 was used to measure viscosity, 50 ml of hair serum was put in the beaker, and the viscosity was assessed at 10, 20, 50, and 100 rpm.[43]

Spreadability

A similar plate procedure that is frequently used to evaluate and measure the spreadability of semisolid medicines was utilised to measure spreadability. One gram hair serum was pressed between two vertical plates of dimension 20 multiplied 20cm, the of which counted 125 gm. The spread periphery was measured after 1 min. Spreadability was calculated using the following formula.

$S = M \times L/T$

where S stands for spreadability, M for weight (attached to upper slide), and L for length moved by glass slide, T for time (in sec) taken to separate the slides completely.[42]

Stability

Stability tests using the freeze-thaw method: The formed product was refrigerated to 4°C before being kept at room temperature until it reached its normal temperature of 28°C. The same three cycles were carried out.

To assess the interactions between drugs and excipients, Fourier transform infrared spectroscopy (FTIR) was carried out using potassium bromide pellets.[44,45]

Sterility test

The sterile discs were loaded with 1% hair serum and incubated for 24 hours at 32°C as part of the sterility tests on nutrient agar.[44,45]

Hair growth activity test

A single rabbit was subjected to this test in three locations, each measuring 4 in. x 4 cm, on either the right or left foot. Depilatory cream was then administered, and the region was clean and haired within 3-5 minutes. Before any action evaluation, the rabbit was left behind for 24 hours with 70% ethanol added as an antiseptic. Treatment 1 served as the standard control since there was no intervention, whereas Treatment 2 served as the positive control since hair serum with the test substance was applied. The rabbit was subsequently given 0.1 ml of each medication twice daily for 3 weeks. Day 0 of using the hair serum was designated as such.[46,47]

Test the sensitivity of eye

Three rabbits were used in the test to get the average eye sensitivity result. The rabbits' left eyes were given one drop of hair serum in physiological naphthalene (the right eye served as the control), and the rabbits were then observed for 30, 60, 120, and 240 minutes as well as one, two, three, and four days. Conjunctiva, iris, and cornea scores were calculated.[48]

Skin sensitivity test (Draize skin test)

The skin sensitivity examination was an initial examination to detect any allergic reaction that may be caused by the hair serum. Hair on the right and left back were shaved and divided into 6 religions each with a size of 4into4 cm in a rectangular shape with a distance of 1.5 cm between the square. Each square was number 1-6. Before using a hair tonic and after shaving. No 1-5 represents.

No. 1: No tonic was applied/ normal control, no. 2: Have control was applied/ placebo, no. 3: Hair serum 2.5% was applied, no. 4: 5% of hair serum was applied and no. 5: 10% of hair serum was applied.

Any sensitivity of the skin such as erythema, edema and peeling were observed at 24 hours and 48 hours after the application.[49]

Observations of the growth of hair length

It was done by taking 10 random hair strands on each box on days 7, 14 and 21. The hair has to measured using Mitutoyo digimatic wireless callipers by straighten hair, and stuck with the tape. The average length collected was analysed to check if the variation between the research region and the control were statistically significant.[50,42]

Quality assessment of hair growth

Any visible method of qualitative hair growth analysis was used inspection of 2 criteria, initial hair growth on the time (minimum time needed for hair growth on the shaved area, measured from the darkening of the skin colour showing initial hair growth) and the least amount of time necessary for the complete shaved region to regenerate hair covered with new hair on three groups. (Group 1: Normal control; group 2: Negative control: group 3: Positive control herbal hair serum). Each group consists of three rabbits.[51]

CONCLUSION

Since all the added ingredients have many benefits and all the parameters indicated that they are within acceptable ranges, this hair serum will support the growth of natural hair while preserving healthy hair growth and supplying the sebaceous glands with the vital nutrients they require to continue functioning as intended. The usage of herbal cosmetics has undergone significant modification within the context of personal hygiene and the healthcare system. As a result, the sector for herbal cosmeceuticals, which truly focuses and pays special attention to the creation of herbal cosmetics, has a great deal of glitter. During the testing time, the formulations didn't cause any redness or

itching. The compositions were shown to have strong antibacterial properties.

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