

FORMULATION & EVALUATION OF HERBAL HAIR GEL

GAIKWAD SAURABH DILIP, PAWAR DIPAK SHIVAJI, THORAT SWAPNIL AMRUT, YADAV PRATIK DHANLAL, SHEWALE GAURAV SUNIL

DHARMARAJ SHAIKSHANIK PRATISHTHAN COLLEGE OF PHARMACY,
WALKI, AHMEDNAGAR (MH) INDIA

ABSTRACT: -

Dandruff is a skin condition with symptoms includes flaking and sometimes mild itchiness cause to the scalp. They are many bacteria, fungus causing scalp infections which lead to further hair problems or skin issues. There is one of the common conditions candidiasis which is typically caused on the skin or mucus membrane caused by candida. Herbal extract of flaxseed and amla found to be effective in treating Candidiasis. Flaxseed (*Linum sitatissimum*) is an annual plant of the linaceae family with several biological properties such as an indirect effect on hair regrowth through the intermediary of γ -glutamyltran speptidase. Flax seed gel has several benefits on 4C hair. The gel is rich in omega-3 fatty acids, vitamins, minerals and Lignin which nourish the hair and promote growth. The omega-3 fatty acids in flaxseed gel is responsible for moisturizing the hair. Flax seeds are one of dietary sources containing considerable amount of phenolics named lignans. The aim of this study was to evaluate the potential activities of lignan extracts as a potential source of antimicrobial agents like secoisolariciresinol diglucoside (SDG) in variables levels. In the present investigation, we present the antibacterial activity and antifungal activity of Flax seeds extracts with unique composition of different phenylpropanoid compounds. Due to the elevated level of secoisolariciresinol diglucoside (SDG), ferulic acid, p-coumaric acid, their glucosides and also their multi directional mode of action the Flax seeds (Extract) were effective in inhibiting bacterial growth and fungal growth. A polyherbal hair gel was found to be effective against candidiasis along with this it nourished the hair and prevent premature graying.

INTRODUCTION:-

Flaxseed (also known as linseed) is emerging as an important functional food ingredient because of its rich contents of α -linolenic acid (ALA, omega-3 fatty acid), lignans, and fiber.^[1] Flaxseed oil, fibers and flax lignans have potential health benefits such as in reduction of cardiovascular disease, atherosclerosis, diabetes, cancer, arthritis, osteoporosis, autoimmune and neurological disorders.^[2] Apart from this, flaxseed is full of fatty-acids and anti-oxidants which help to remove toxins and dead cells from the scalp. Flax seed gel can be applied to scalp and hair as a moisturizer that can help to stimulate growth and improve the strength of existing hair.^[3]

Topical formulations include oils, creams, ointments, pastes and gels out of which gels are getting more popular now a days because they are more stable and also can provide controlled release than other semisolid preparations. The gel formulations can provide better absorption characteristics and hence the bioavailability of drug.^[4] Gels are semisolid systems in which a liquid phase is constrained within a three dimensional polymeric matrix (consisting of natural or synthetic gums) in which a high degree of physical or chemical cross-linking has been introduced.^[5] Gels are relatively newer class of dosage forms created by entrapment of larger amount of aqueous hydro alcoholic liquids in a network of colloidal solid particles which may consist of inorganic substance such as aluminium salts or organic polymers of natural or synthetic origins.^[6]

□ Hair Scalp Infection

Dandruff is skin condition with Symptoms includes flaking and sometimes mild itchiness cause to the scalp.^[7] There are many bacteria, Fungus causing scalp infections which leads to further hair problems or skin issues. There is one of the common conditions candidiasis which is typically caused on the skin or mucus membrane caused by candida. As skin is the protective layers of body against infection but this yeast leads to skin conditions and if it multiplies it can become pathogenic. This fungus thrives mostly in moist, warm and sweaty conditions, there been some subdivisions in case of Candidiasis based on the areas of body and also consist of approx 150 species among these *Candida albicans* is most prevalent, This yeast is supposed to be present in healthy people. The symptom varies on basis of body location, focusing on the scalp problem the symptoms such as rash and white flaky substance over affected area is formed. There are many allopathic formulation treatments for this infection.^[8] *Malassezia* most commonly present in patients with higher levels of sebaceous secretion because of *malassezia* feed off of lipids.^[9] Folliculitis is a skin syndrome which is commonly found in population and cause inflammation to the skin. Several microbial agents act as causative



Fig. 1.1 Difference between candidiasis and follucilitis

Flaxseed has long history of use in India and flaxseed preparations are particularly considered for its nutrients and therapeutic property. In Southern India, flaxseed is partly being consumed by at lower levels as flaxseed chutney. *Linum Usitatissimum* L, the linseed producing plant belongs to the family Linaceae. Flax seed gel has several benefits on 4C hair. The gel is rich in omega-3 fatty acids, vitamins, minerals and Lignin which nourish the hair and promote growth. The omega-3 fatty acids in flaxseed gel is responsible for moisturizing the hair. The presence of vitamin E in flaxseed provides nutrition to the scalp and reduces free radical damage. Flaxseed is rich in omega-3 fatty acids It can also reduce inflammation "It nourish dry, damaged hair, and fatty acids have been touted for their ability to provide moisture." Flaxseed gel helps hair grow faster and longer by providing nourishment to the hair follicles.

Vitamin E is antioxidant it reduces the effects of free radicals on your scalp, thereby promoting hair growth. Adequate vitamin E intake may also promote stronger hair follicles. ^[11]

Flaxseed is full of fatty-acids and anti-oxidants which help to remove toxins and dead cells from the scalp. Flax seed gel can be applied to scalp and hair as amoisurizer that can help to stimulate growth and improve the strength of existing hair. ^[12]

"Flaxseed gel helps hair grow faster and longer by providing nourishment to the hair follicles," explains Celeste Arnold, senior stylist and owner of Celeste Arnold Hair and Makeup. "The presence of vitamin E in flaxseed provides nutrition to the scalp and reduces free radical damage." Flaxseeds extracts with unique composition of different phenyl propanoid compounds. Due to the elevated level of secoisolariciresinol diglucoside (SDG), ferulic acid, p-coumaric acid, their glucosides and also their multi directional mode of action the Flax seeds (Extract) were effective in inhibiting bacterial growth and fungal growth. ^[11-13]

Common names:

Flax seed, linseed, Alsi or teesi (Hindi, Gujarati, and Punjabi), Ali vidai in Tamil ,Atasi and Jawas in Marathi, Tishi in Bengali, Pesi in Oriya, Agasi in Kannada, Aviseginzalu in Telugu, and Cheruchanavithu in Malayalam. ^[14]

Biological Source:-

Linseed is the dried, ripe seed of *Linum usitatissimum* Linn. Linseed oil is obtained by expression of linseeds, belonging to family Linaceae.

Scientific name : *Linum usitatissimum*

Kingdom: Plantae

Order: Malpighiales

Family: Linaceae

Genus: *Linum*

Species: *L. usitatissimum*



Fig.1.2 Flax seed

Studies have reported that Flax is a plant and has been a stable part of farming for hundreds of years and every part of it was usable. The seeds for food and the production of linseed oil (another name for Flax and is a good preserver of wood as well as good for our bodies) and the stems for example can be used to produce linen fiber for clothes and other products. The oil industry (petroleum) removed some of the needs of Flax and so its production took a decline especially after the II World War commonly cultivated Flax plants are named *Linumusitatissimum* ^[15] Cultivated Flax plants grow to 1.2m (3ft 11in) tall, with slender stems. The leaves are glaucous green, slender lanceolate, 20-40mm long and 3mm broad. The flowers are pure pale blue, 15-25mm diameter, with five petals. The fruit is a round, dry capsule 5-9mm diameter, containing several glossy brown seeds shaped like an apple ip, 4-7mm long.

flax (*Linum usitatissimum*) is a true flowering crop that produces small, flat seeds ranging in color from golden yellow to reddish brown. The seeds are commonly consumed in one of three ways whole seed, ground seed (powder or meal), or flaxseed oil. In the last decade, faxed has garnered attention due to its reported heath benefits. The American Botanical Council reported a 177% increase in sales of flax products in 1999 alone. ^[16]

Most of the benefits reported from flaxseed consumption are believed to the following three importance components found in flaxseeds, **α -linolenic acid (ALA), lignans, and fiber.** [17]

Flaxseed oil

Flaxseed of differs from whole and ground flaxseed by being devoid of both fiber and lignans. It is a unique of in that it is composed of 73% polyunsaturated fatty acids (PUFA), 18% monounsaturated fatty acids (MUFA) and 9% saturated fatty acids (SFA), making it a low-saturated fat food. It is also the richest known source of the omega 3 n-3 fatty acid, ALA, which comprises 55% of the total fatty acids. In fact, the percent of fat as ALA in flaxseed oil is 5.5 times higher than the next highest sources, warts and canola oil. [18]

Flaxseed and its derivative, flaxseed oil/linseed oil, are rich sources of the essential fatty acid alpha-linolenic acid (ALA), which is a biologic precursor to omega-3 fatty acids such as eicosapentaenoic acid (EPA). Although omega-3 fatty acids have been associated with improved cardiovascular outcomes, evidence from human trials is mixed regarding the efficacy of flaxseed products for coronary artery disease or hyperlipidemia. [19]

The lignan constituents of flaxseed (not flaxseed oil) possess in vitro antioxidant and possible estrogen receptor of agonist/antagonist properties, prompting theories of efficacy for the treatment of breast cancer. As a source of fiber mucilage, oral flaxseed (not flaxseed oil) may possess laxative properties, although only one human trial has been conducted for this indication. [20] In large doses, or when taken with inadequate water, flaxseed may precipitate bowel obstruction via a mass effect. The effects of flaxseed on blood glucose level are not clear, although hyperglycemic effect have been reported in one case series [21]

HERBAL TREATMENT: -

□ Flaxseed:-

□ For hair:-

Flaxseed has long history of use in India and flaxseed preparations are particularly considered for its nutrients and therapeutic property. In Southern India, flaxseed is partly being consumed by at lower levels as flaxseed chutney. *Linum Usitatissimum* L, the linseed producing plant belongs to the family *Linaceae*. [11] The Vitamin E in flaxseed oil helps to treat hair loss and stimulate new hair growth. Lignans act as strong antioxidants which can help in the regrowth of healthier and stronger hair. Topical application of flaxseed oil prevents flaking and nourishes the scalp from within, providing relief from dandruff. [22]

The presence of vitamin E in flaxseed provides nutrition to the scalp and reduces free radical damage. Flaxseed is rich in omega-3 fatty acids It can also reduce inflammation "It nourish dry, damaged hair, and fatty acids have been touted for their ability to provide moisture." Flaxseed gel helps hair grow faster and longer by providing nourishment to the hair follicles. Vitamin E is antioxidant it reduces the effects of free radicals on your scalp, thereby promoting hair growth. Adequate vitamin E intake may also promote stronger hair follicles. [13]

Flax seeds are one of dietary sources containing considerable amount of phenolics named lignans. Present the antibacterial activity and antifungal activity of Flax seeds extracts with unique composition of different phenylpropanoid compounds. Due to the elevated level of secoisolariciresinol diglucoside (SDG), ferulic acid, p-coumaric acid, their glucosides and also their multi directional mode of action the Flax seeds (powder extract) were effective in inhibiting bacterial growth and fungal growth. We aimed to evaluate activity of Flax seeds powder extract against the bacteria and fungi of clinical relevance: *Escherichia coli*, *Salmonella paratyphi*, *Lactobacillus* and *Staphylococcus aureus*, *Proteus vulgaris*, *Klebsiella pneumoniae*, *Saccharomyces cerevisiae* known to be causes of antibiotic-resistant infections. We performed the agar diffusion method and indicated the bacteriostatic or bactericidal action and fungistatic or fungicidal action. We suggest that extracts derived from Flax seeds might be the effective source of antibacterial compounds and the promising alternative to antibiotic therapy. [23-24]

□ Antioxidant Effects :-

Omega-3 fatty acid have been show to oxygen free radical from neutrophils and monocytes, as well as the production of interleukin-1, tumor necrosis factor, and leukotriene B₄ (LTB₄). [25] "Lignans can act as platelet activating factor receptor antagonists and inhibit the production of oxygen free radicals by neutrophils." [26-27] SDG, a plant lignan found in flaxseed, has been found to possess antioxidant properties. [28] Theoretically, flaxseed (not flaxseed oil) may increase lipid peroxidation and thus increase oxidative injury. [28] "Diets supplemented with defatted flaxseed have been associated with a decrease in protein thiol groups, suggesting an increase in oxidative stress." [29]

□ Allergy :-

Known allergy or hypersensitivity to flaxseed, flaxseed oil, or any other members of the *Linaceae* plant family or *Linum* genus plant family. Hypersensitivity reactions to flaxseed following occupational exposure to the powder have been reported anecdotally. "Case reports have noted palmar pruritus, generalized urticaria, ocular pruritus/weeping, nausea/ vomiting, intestinal/abdominal pain, vomiting, diarrhea, acute dyspnea without bronchospasm, hydro rhea, successive sneezing, nasal obstruction, and intense general malaise from consuming linseed oil (from flaxseed or multigrain bread). [30-31]

Plan of work:-**1. Organoleptic Properties:-**

The colour of herbal gel formulation were found to be dark white with translucent appearance which was found to be smooth on application. translucent appearance which was found to be smooth on application.

- **Colour:-**
- **Odour:-**
- **Appearance:-**

2. pH determination:-

The pH of the herbal gel formulations ranged between 6.7 hair, indicating the compatibility of the herbal gel formulations with the hair.

3. Homogeneity :-

The developed gels were tested for homogeneity by visual inspection for appearance and presence of any lumps, flocculates or aggregates. The homogeneity was found to be good of herbal gel formulation.

4. Viscosity determination :-

Viscosity is an important parameters for characterizing the gels as it effect the spreadability, extrudability and release of the drug. The viscosity of the formulations were found in the range of 1,50,232 to 1,52,876 cps. From the results it is clear that as the concentration of flaxseed extract increased from 5% to 20% the viscosity of the formulations also increased.

5. Spreadability:-

Spreadability plays an important role in patient compliance and help in uniform application of gel to the hair. A good gel takes less time to spread and will have high spreadability. The spreadability of formulated gel was decreased as the concentration of gelling agent increased.

MATERIALS AND METHODS OF BASE:-**□ Materials Used:-**

Flaxseeds were procured from the local organic farm, Bengaluru, India. Carbopol 934, Methyl paraben and Sodium chloride and Reagents use were of either analytical or laboratory grade.



Fig. 2.1 base formulation of hair gel



Fig. 2.2 Mechanical Stirrer

The gels formed using 0.5g carbopol 934 were found to be very thin that liquefied within 4 to 5 hours of preparation. The gel formed using 1g carbopol 934 gel formation was better to some extent but the problem of liquefaction after 24 hours was observed. The gel formulation containing 1.5g of carbopol 934 formed uniform and smooth gel that did not liquefy even after 24 hrs. With 2g carbopol 934 the gel formation was better to some extent but problem was too thick to handle. Whereas gel containing 2.5g carbopol 934 was too thick to be handled.

Among the five formulations, gel containing 1.5g carbopol 934 (F3) was optimized.

□ **Use of Ingredients And it's Category:-**

Table 1.2 Ingredients And it's Category

Sr. No.	Ingredients	Category
1.	Flaxseed extract	Anti-Bacterial & Anti-Fungal
2.	Carbopol 934	Gelling agent
3.	Methyl paraben	Preservative
4.	Sodium Chloride	pH adjuster
5.	Neutral blue	Colorant

□ **Extraction process**

1) All of the flaxseeds used in the extraction were acquired from a local store. For extraction, it was important to use a mechanical flaxseed preparation technique. Because hull separation could pose a technical challenge and crushing the seeds would result in the extraction of other substances, such as proteins, which are primarily found in the endosperm, lowering the quality of the mucilage extract, therefore the extraction from the whole seed was suitable. It is also not a good idea to extract mucilage from the meal after the oil has been extracted since this will result in protein extraction. As a consequence, flaxseed mucilage extraction from the entire seed was successful.^[32]

2) Flaxseed mucilage was extracted using distilled water in an aqueous method. Weighed the flaxseeds and put them in distilled water. Heat this mixture as well as stir it for at least 12 to 15 minutes on the magnetic stirrer. Then filter the resulting gel/extract with a clean muslin cloth.^[32]

3) The aqueous extract of flaxseed was prepared by adding flaxseeds to boiling water with constant stirring until a thick mucilage was obtained. Then the mucilage was strained using suitable sieve and stored at room temperature until further use.^[33]

□ **Preparation of Herbal Hair Base**

The aqueous extract of flaxseed was prepared by adding flaxseeds to boiling water with constant stirring until a thick mucilage was obtained. Then the mucilage was strained using suitable sieve and stored at room temperature until further use.^[34]

Herbal hair gel formulation were prepared by simple gel preparation method with carbopol 934 gel base. Measured quantity of methyl paraben and weighed quantity of sodium chloride were dissolved about 35ml water in beaker. Then the mixture was stirred at high speed using mechanical stirrer.

1.5g carbopol 934 (optimized) and add 20% aqueous extract of flaxseed to beaker and continuous stirring to obtain gel structure. The prepared herbal gel formulations were stored at room temperature until further evaluation.



Evaluation of Base formulation:-**1. Physical Properties:-**

The physical appearance was visually checked for the appearance, colour and the odour application of prepared base gel formulations.

- **Colour:-** Dark White
- **Odour:-** Distinctive
- **Appearance:-** Smooth And Homogeneous

2. pH determination :-

The pH of all hair gel formulations were determined by using the digital pH meter.^[36] One gram of gel was dissolved in 100 ml distilled water and stored for two hours. Electrodes were completely dipped into the hair gel formulations and pH was noted. The measurement of pH of each formulation was done in triplicate and average values were calculated.

Result of pH range :- The pH of all base formulation ranged between 6.7 to 7.3, that suited the gel formulation, indicating the compatibility of the base formulation with hair.

3. Homogeneity :-

After the gel formulations have been set in the container, all developed gels were tested for homogeneity by visual inspection. They were tested for their appearance and presence of any lumps, flocculates or aggregates.^[37]

4. Viscosity determination :-

Brookfield viscometer was used to determine viscosity. Sufficient quantity of gel was filled in wide mouth jar separately.

Viscosity is an important parameters for characterizing the gels as it effect the spreadability, extrudability and release of the drug, all formulated gels showed in increased viscosity as the concentration of the gelling agent was increased. The height of the gel in the jar should be sufficient to allow to dip the spindly. The RPM of the spindle was adjusted to 2.5 RPM. The viscosities of the formulations were recorded.

Result of viscosity :- The viscosity of all the gel formulations were found in the range of 1,50,232 to 1,52, 876 cps. From the result it is clear that as the concentration of formulation increased from 5% to 20% the viscosity of the gel formulation also increased.

5. Spreadability:

Area of extent to which topical application spread on skin is called as spread ability.

Topical formulations need to spread over surface of site for their therapeutic action so their efficacy depends upon its spreading value. Spreading value determination done by placing excess of sample (3g) in between two glass plates and compressed to uniform thickness by placing 1 kg weight over it for 5 minutes. At the end weight (50g) was added to the pan and the top plate was subjected to pull with the help of string attached to the hook. The time requires to move upper plate over lower for 10 cm is recorded. Those Formulation shows lower sliding time having better spread ability.

Spreadability (S) was calculated as in Eq 1.

$$S = M.L/t \dots\dots\dots (Eq 1)$$

Where,

M is the weight (g) tied to the upper glass slide L is the length (cm) moved on the glass slide, and t is time (sec).

Extraction and Preparation Methods**□ Extraction process**

1) All of the flaxseeds used in the extraction were acquired from a local store. For extraction, it was important to use a mechanical flaxseed preparation technique. Because hull separation could pose a technical challenge and crushing the seeds would result in the extraction of other substances, such as proteins, which are primarily found in the endosperm, lowering the quality of the mucilage extract, therefore the extraction from the whole seed was suitable. It is also not a good idea to extract mucilage from the meal after the oil has been extracted since this will result in protein extraction. As a consequence, flaxseed mucilage extraction from the entire seed was successful.^[19]

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□ Preparation of Herbal Hair Gel

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1.5g carbopol 934 (optimized) and add 20% aqueous extract of flaxseed to beaker and continuous stirring to obtain gel structure. The prepared herbal gel formulations were stored at room temperature until further evaluation.

Evaluation of Gel formulation:-**1. Physical Properties:-**

The physical appearance was visually checked for the appearance, colour and the odour application of prepared base gel formulations.^[35]

- **Colour:-**
- **Odour:-**

- **Appearance:-**

2. pH determination :-

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Conclusions: -

The formulation of Flaxseed hair gel provides a good base for treating the scalp and strengthens the hair thereby preventing the Anti-Bacterial & Anti-Fungal. There is a further scope for pharmacological studies. In carbopol gel formulations, the drug release was decrease with increase in carbopol concentration because polymer concentration increases the viscosity. Viscosity is negatively related to the release of active substance from formulations. Stability studies in all gel formulations showed that, the physical appearance, drug content, pH, rheological properties, and drug release in all gel formulations remain unchanged upon storage for one month.

Antimicrobial activity shows that formulation of gel shows higher efficacy without any dermal irritancy. Moreover the optimized formulation showed no signs of irritation or inflammation. The formulation of Flaxseed hair gel provides a good base for treating the scalp and strengthens the hair thereby preventing the hair fall.

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