

“EXPLORING NATURAL REMEDIES FOR DANDRUFF: AN EVIDENCE -BASED REVIEW”

Dr. A. Seetha Devi*, Professor, Gokaraju Rangaraju College of Pharmacy, Bachupally, Hyderabad.

Md. Taha Fathima, Gokaraju Rangaraju College of Pharmacy, Bachupally, Hyderabad.

D. Surya Prathap, Gokaraju Rangaraju College of Pharmacy, Bachupally, Hyderabad.

***Corresponding author:**

Dr. A. Seetha Devi

‘Department of Pharmaceutics, Gokaraju Rangaraju College of Pharmacy, Bachupally, Hyderabad – 500090, India

Abstract

Dandruff is a prevalent scalp disorder affecting a significant portion of the global population. It is primarily associated with the overgrowth of *Malassezia furfur*, a fungal species that triggers scalp irritation, inflammation, and excessive flaking. This review explores the causes, pathophysiology, and treatment approaches for dandruff, focusing on natural remedies as a sustainable alternative to commercial anti-dandruff products. Various plant-based treatments, including herbal shampoos, oils, masks, rinses, and supplements, are discussed in detail. The effectiveness of key botanical ingredients such as neem, tea tree oil, hibiscus, rosemary, and fenugreek in alleviating dandruff symptoms is highlighted. The review aims to provide an evidence-based understanding of the efficacy of herbal solutions in managing dandruff, emphasizing their safety, affordability, and environmental benefits over synthetic alternatives.

Keywords

Anti-dandruff agents, scalp disorders, *Malassezia furfur*, natural ingredients, herbal formulations, dandruff treatment, scalp health, antifungal herbs, hair care.

INTRODUCTION

Hair is a component of the integumentary system and extends downward into the dermal layer, where it sits in the hair follicle. Humans have approximately five million hair follicles, which offer protection from cold and UV have a significant psychological impact when growth or

structure is unbalanced. Each strand of hair is made up of two separate structures. The first is the hair shaft, which comprises the visible part outside the skin. The second is the hair follicle, which lies underneath the skin's surface. The hair follicle contains an inner and outer root sheath. The pH of scalp is 5.5 and that of a hair shaft is 3.67. The presence of these sebaceous glands along with the dark and warm environment of the scalp makes it more prone to mycotic infections like dandruff, seborrhoeic dermatitis and even parasitic infections like *Pediculosis capitis*.

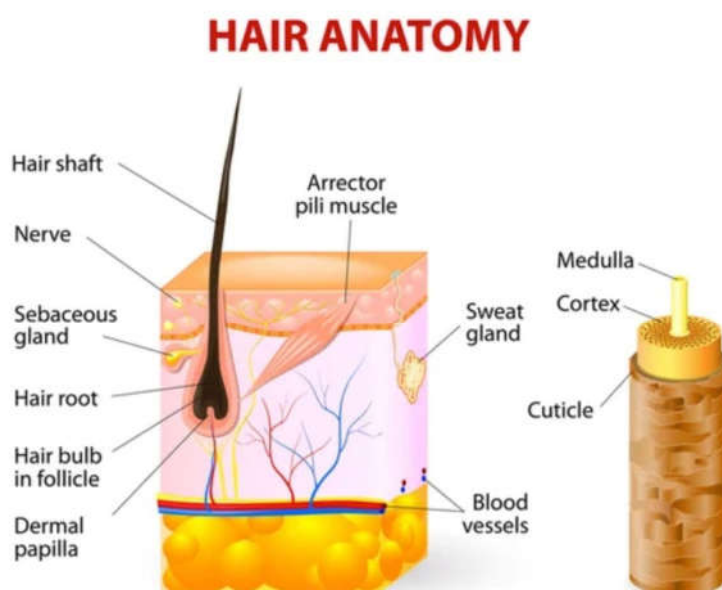


Fig 1: Hair anatomy

Parts of the Hair

Dermal Papillae

The dermal papilla is responsible for regulating the hair cycle and hair growth, and is also comprised of androgen receptors that are sensitive to the presence of DHT.

Matrix

The matrix surrounds the dermal papillae and contains all the active cells needed for hair growth and for the development of the different parts of the hair, particularly the outer root sheath, the inner root sheath and the hair shaft. Combined, the matrix and the dermal papillae make up the hair bulb.

Outer Root Sheath

It covers the entire hair follicle inside the dermis and then transitions through to the epidermis, providing the hair follicle with the outer root sheath, or trichilemmal, is the outermost part of the hair and is keratinized. opening from which to surface from.

Inner Root Sheath

The inner root sheath is comprised of three parts: the Henley layer, Huxley layer, and cuticle. The Henley's and Huxley's layers are capsular layers that anchor onto each other with the purpose of stabilizing the hair. The cuticle, which is the innermost part that is closest to the hair shaft, is made from dead hardened cells and give the hair shaft added protection. This, together with the capsular layers that make up the Henley's and Huxley's layers, secures the hair and allows it to grow in length.

Hair Shaft

The hair shaft is made up of three layers: the medulla, cortex, and the cuticle.

- The **medulla** is described as an unsystematic and unstructured area located in the innermost region of the hair shaft and is not always present.
- The **cortex**, in contrast to the medulla, is highly structured and organized. The cortex is made up of keratin and is responsible for giving hair its strength and durability, as well as its water uptake. The cortex also contains melanin and determines the colour of hair based on the number, distribution and types of melanin granules present.
- The **cuticle** is the hair's outer protective layer and is connected to the internal root sheath. It is a complex structure with a single molecular layer of lipids that helps hair repel water. [1]

TYPES OF SCALP DISORDERS

There are various types of Scalps disorders some common and some uncommon. These include

1. Alopecia- Hair loss

2. Seborrheic Dermatitis: inflammation of scalp skin characterized by scaly, itchy, flaky skin.

3. Ring Worm-also known as Tinea capitis is a cutaneous fungal infection of scalp, the causative fungi are *Trichophytum rubrum*

4. Scalp psoriasis- It's a common scalp skin disorder characterized by raised reddish patches that may spread beyond the scalp to forehead or back of the neck or ears.

5. Scalp folliculitis- Inflammation of hair follicle.

6. Dandruff- It is the shedding of the dead skin cells.

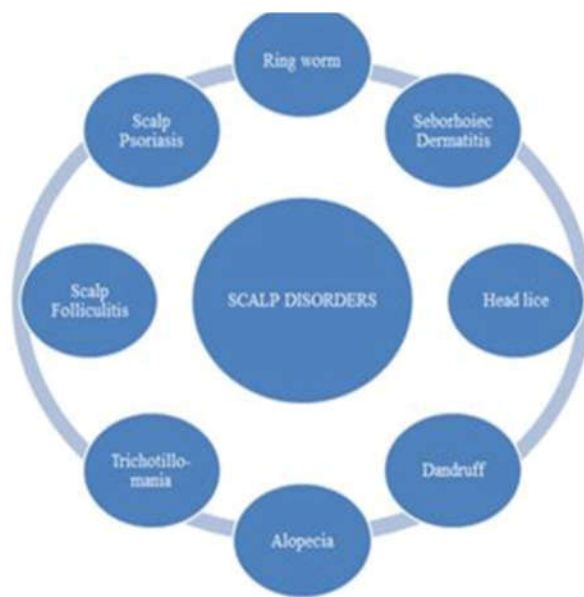


Fig 2: Types of scalp disorders

DANDRUFF

Definition: Dandruff- medically termed pityriasis simplex/ capitis or furfuracea capitis is a chronic condition that is marked by skin flaking on scalp & itching. Term “dandruff” or pityriasis means bran-like epidermal scaling was introduced into the dermatological vocabulary by Gelan.

There are two types of dandruff that usually occur – common (dry/sicca) or oily/steatoides dandruff.

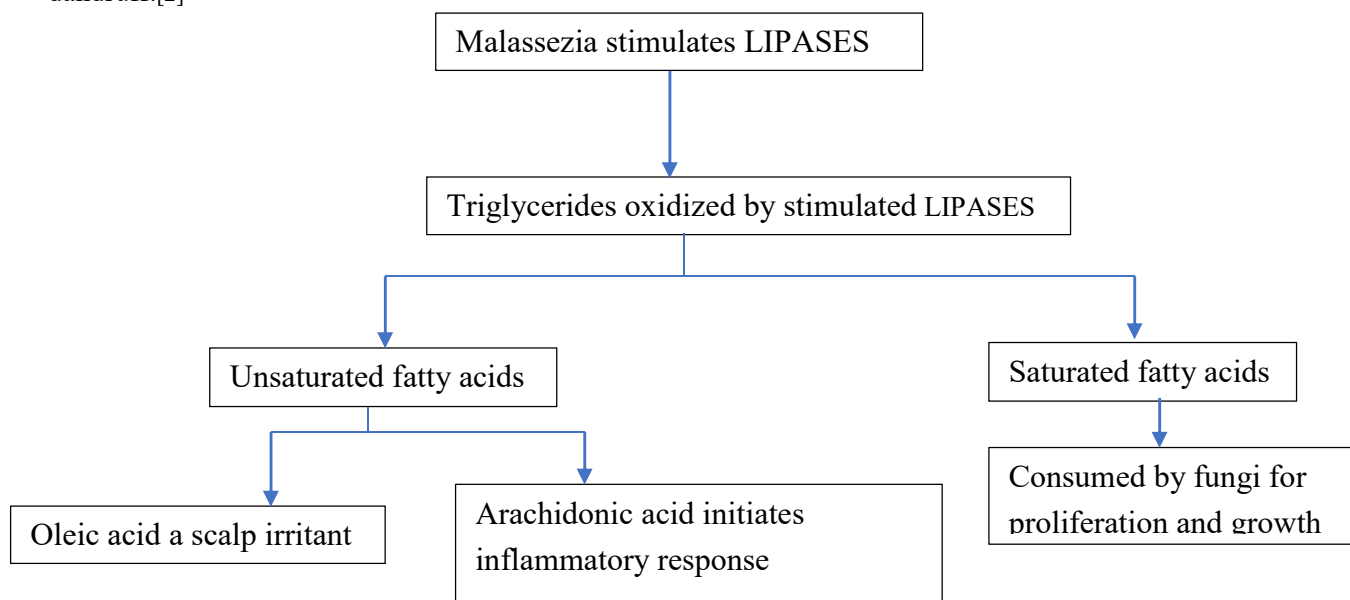
- ❖ It is characterized by presence of corneocytes that form clusters due to their high cohesive power, in the form of flaky white to yellowish.
- ❖ It has been observed that dandruff occurs mainly between puberty to middle- age, the phase when sebaceous glands are most active.

Causes: The cause is unclear but believed to involve a number of genetic and environmental factors. Depending on their susceptibility. Causes can be classified into-

a) Microbial and b) non-microbial.

a) Microbial Factors:

1.FUNGAL: Malassezia furfur is considered as the leading cause of dandruff. The fungi - Malassezia can lead to dandruff by either or both of the following mechanisms-Malassezia stimulates the enzyme called Lipase on the scalp. The enzyme causes oxidation of triglycerides of sebum to produce unsaturated and saturated fatty acids. Saturated fatty acids are consumed by the fungi for self-proliferation and growth. Unsaturated fatty acids include oleic acid and arachidonic acid. Oleic acid is an irritant for human skin while arachidonic acid is involved in potentiating the inflammatory responses. Hence the result of the degradation of the fatty acids is scalp skin irritation, inflammation and fungal growth. These further cause dry flakes called dandruff.[2]



Flow chart of Malassezia furfur

b) Non microbial Factors:

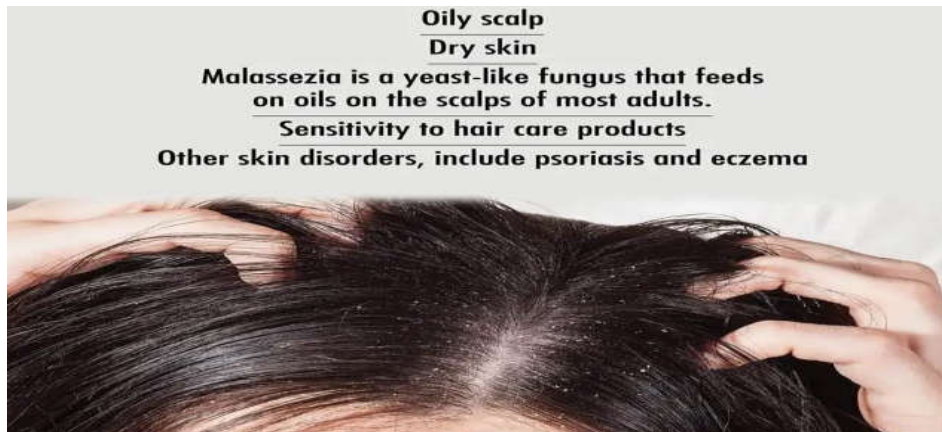
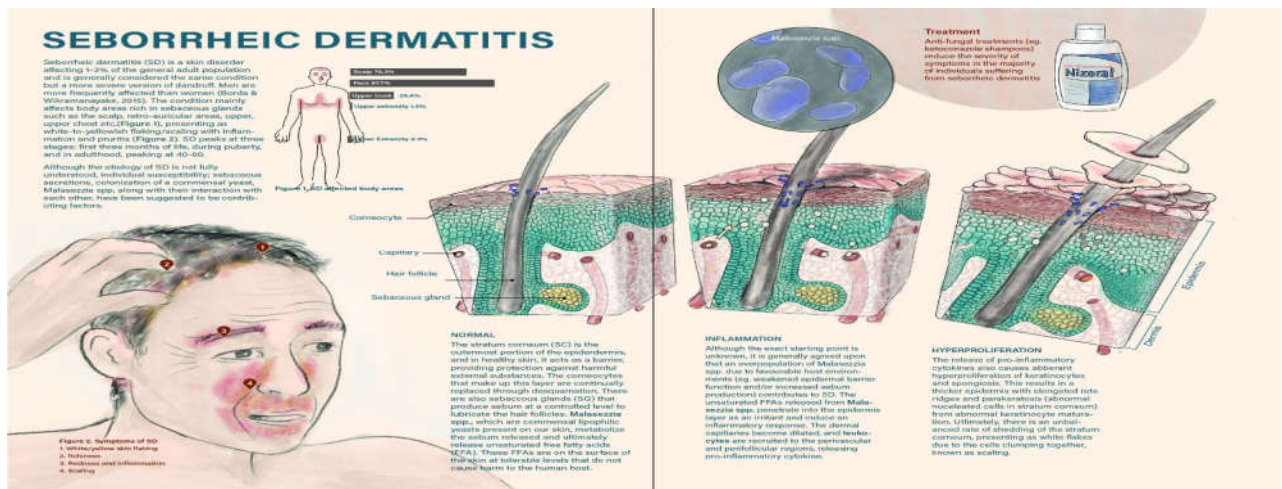


Fig 3: Non-microbial factors

Seborrhoeic dermatitis

- In seborrhoeic dermatitis, redness and itching frequently occur around the folds of the nose and eyebrow areas, not just the scalp. Dry, thick, well-defined lesions consisting of large, silvery scales may be traced to the less common condition of scalp psoriasis. Inflammation can be characterized by redness, heat, pain or swelling, and can cause sensitivity.
- Inflammation and extension of scaling outside the scalp exclude the diagnosis of dandruff from seborrhoeic dermatitis
- Seasonal changes, stress, and immunosuppression seem to affect seborrheic dermatitis.



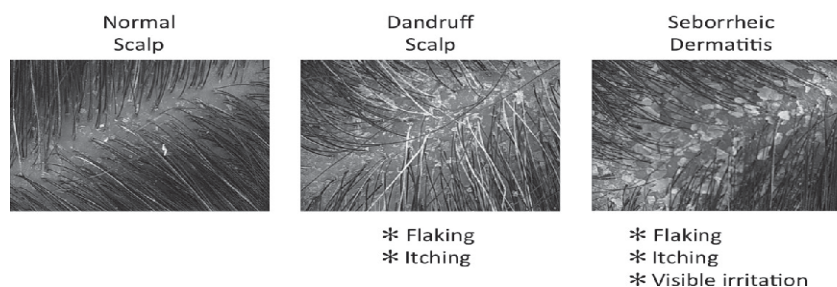


Fig 4: Seborrheic dermatitis

Pathophysiology

Histologically, the development of SD can be divided into two stages. In the acute and sub-acute stages, SD shows superficial perivascular and perifollicular inflammatory infiltrates, composed mainly of lymphocytes and histiocytes in association with spongiosis and psoriasiform hyperplasia, and can be coupled with parakeratosis around follicular opening(shoulder parakeratosis).

- Dandruff shows many common features as SD in histology, such as epidermal hyperplasia and *Malassezia* yeasts surrounding the parakeratotic cells.
- Whereas inflammatory cells such as lymphocytes and NK cells may be present in great numbers in SD, dandruff shows subtle neutrophil infiltration or no infiltration.

Studies have identified several predisposing factors, including fungal colonization, sebaceous gland activity, as well as several factors that confer individual susceptibility.

Fungal colonization

Malassezia are lipophilic yeasts that are found mainly on seborrheic regions of the body. Studies have detected *Malassezia* on the scalp of dandruff patients and higher numbers of *Malassezia* (*M. globosa* and *M. restricta*) correlate with SD appearance/severity.

- ❖ *Malassezia* was shown to have lipase activity, which hydrolyses human sebum triglycerides and releases unsaturated fatty acids such as oleic and arachidonic acid.
- ❖ These metabolites cause aberrant keratinocytes differentiation, resulting in stratum corneum abnormalities such as parakeratosis, intracellular lipid droplets, and irregular corneocyte envelope.
- ❖ Such changes lead to disrupted epidermal barrier function and trigger inflammatory response, with or without visible local inflammation.

Sebaceous gland activity

Sebaceous glands (SGs) are distributed over the entire skin surface in humans, except on the palms and soles. SGs are activated at birth under the influence of maternal androgens via androgen receptors in sebocytes. During the period of active sebum secretion, the secretion rate is higher in males and stays high longer, between 30 and 60 years of age; in females, the rate drops fast after menopause. In addition to the level of sebum production, abnormalities of lipid composition may also play a role in SD development, likely through a favourable milieu for *Malassezia* growth. The elevated levels of free fatty acids and cholesterol may be the result of triglyceride degradation by *Malassezia*'s lipase, and these metabolites promote *Malassezia* growth.

Individual susceptibility

Besides sebaceous activity and *Malassezia* colonization, other factors also contribute to the pathogenesis of SD. Epidermal barrier integrity, host immune response, neurogenic factors and emotional stress, and nutritional factors have all been shown to play a role in individual susceptibility.[3]

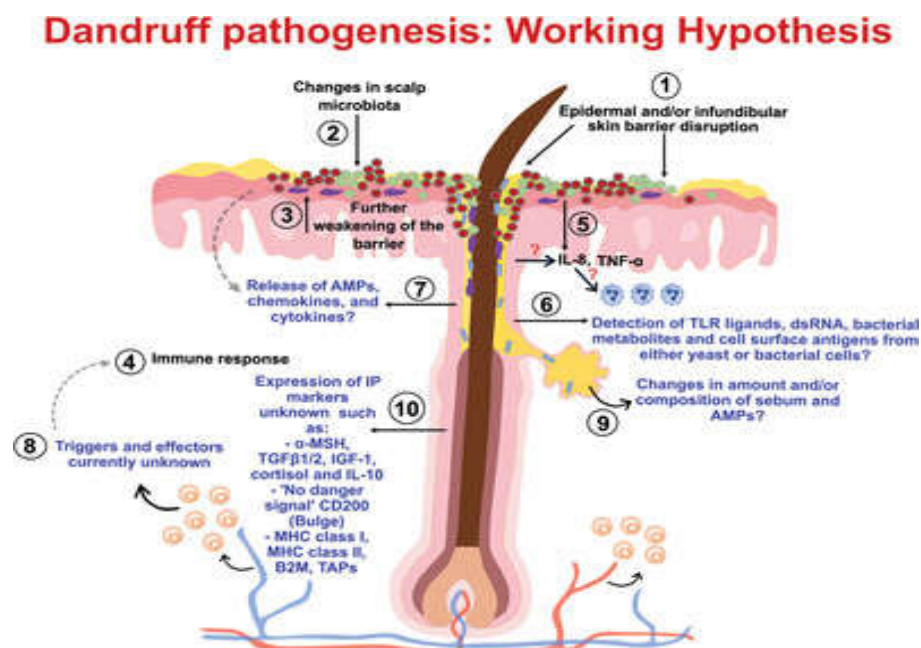


Fig 5: Dandruff Pathogenesis

Treatment:

1. Follow a healthy diet and lifestyle: A diet that provides enough zinc, B vitamins and certain fats may help prevent dandruff.
2. Manage stress: Stress affects overall health, making you susceptible to several conditions and diseases. It can even help trigger dandruff or worsen existing symptoms.
3. Develop a hair and scalp care routine that suits you. If you tend to have an oily scalp, daily shampooing may help prevent dandruff. Gently massage your scalp to loosen flakes. Rinse thoroughly. If your hair tends to be dry and your scalp is sensitive, shampoo less frequently and condition your scalp between washings.

Use of herbal medicine in the treatment of dandruff are as follows:

- **Use of herbal shampoo**
- **Use of Hair oils**
- **Use of herbal hair masks**
- **Use of Herbal rinses**
- **Use of Herbal scalp treatments (Leave in treatments)**
- **Use of Herbal teas**
- **Use of Herbal powders**
- **Use of Herbal capsules or tablets**

Herbal Anti-Dandruff Hair Shampoo:

Herbal dandruff shampoo does not contain any unsafe elements; unlike synthetic shampoo, it is obtained naturally from organic ingredients and medicated specifically to treat dandruff problems. Herbal dandruff shampoo is safe for daily use and gives nutrients and other essential vitamins to your hair and scalp.[4]

They are used for the removal of oils, dandruff, dirt, environmental pollution, etc.

ADVANTAGES OF HERBAL SHAMPOO:

- ▶ Herbal shampoos are made out of pure and organic ingredients, there are no synthetic additives or surfactants are free of any side effects.
- ▶ Are bio-degradable and earth-friendly.
- ▶ It doesn't irritate the eyes.

- ▶ It is cost friendly, and not much expensive.
- ▶ Regular usage of herbal shampoo can do wonders for your hair.
- ▶ By using herbal shampoo, you can get the perfect oil balance.
- ▶ They are made out of natural essential antiseptic properties that protect our hair and scalp from the harsh UV rays of the sun thus preventing skin infections.[4]

Examples: Khadi natural amla & bhringraj shampoo, Indulekha Bringha Shampoo, Kesh king Ayurvedic shampoo.

B) Herbal Hair Oils:

Herbal hair oils are a popular choice for natural hair care, as they can nourish and strengthen the hair and scalp with plant-based ingredients.[5]

Some common herbs used in these oils include:

1. Amla (Indian Gooseberry) – Known for promoting hair growth, strengthening hair follicles, and preventing premature graying.
2. Bhringraj – Often called the "king of herbs" for hair, it is known to help with hair fall, dandruff, and promoting thicker hair.
3. Neem – Great for treating scalp infections, dandruff, and promoting healthy hair growth.
4. Coconut Oil – Often used as a base oil, it is deeply moisturizing and helps with scalp health.
5. Lavender – Known for its calming properties and can improve circulation to the scalp, promoting hair growth.
6. Rosemary – Often used to improve circulation to the scalp, helping with hair regrowth and overall health.
7. Fenugreek (Methi) – Can help reduce dandruff and promote hair growth by strengthening the hair follicles.
8. These oils can either be used on their own or blended for additional benefits. Some people like to warm the oil slightly before massaging it into the scalp for better absorption.

ADVANTAGES OF HERBAL HAIR OILS:

- 1.Nourishment and Moisturization
- 2.Promotes Hair Growth

3. Prevents hair loss
4. Improves scalp health
5. Reduces split ends and breakage
6. Prevents premature greying

C) HERBAL HAIR MASK

These masks offer a variety of advantages for hair and scalp because of their combination of healthy ingredients like saponins, tannins, vitamins, minerals, antioxidants, and acids. They leave your hair feeling clean, silky, and manageable by gently cleansing the hair and scalp without removing natural oils.[6]

Here are different herbs in preparing effective herbal hair masks:

1. Aloe Vera Hair Mask

- Ingredients: Aloe vera gel, olive oil, honey
- Benefits: Aloe vera hydrates the scalp, soothes irritation, and adds moisture to dry hair.
- How to Prepare:
 - 1.Mix 2 tablespoons of aloe vera gel with 1 tablespoon of honey and 1 tablespoon of olive oil.
 - 2.Apply to your scalp and hair, leave on for 20-30 minutes, and rinse with lukewarm water.
 - 3.Best for: Dry, itchy scalp, and promoting shiny hair.

2. Rosemary & Lavender Hair Mask

- Ingredients: Rosemary essential oil, lavender essential oil, coconut oil, and a few drops of tea tree oil
- Benefits: Rosemary boosts circulation to the scalp, helping with hair growth, while lavender calms and nourishes. This mask also prevents dandruff.
- How to Prepare:
 - Combine 2 tablespoons of coconut oil with 5-6 drops each of rosemary and lavender oil.
 - Massage into the scalp and hair. Leave on for 30 minutes to an hour, then wash with a mild shampoo.
 - Best for: Encouraging hair growth and soothing dry scalp.

3. Fenugreek Hair Mask

- Ingredients: Fenugreek seeds, yogurt, and olive oil
- Benefits: Fenugreek strengthens the hair and helps reduce dandruff and hair fall. The protein in fenugreek strengthens hair follicles, while yogurt provides extra moisture.
- How to Prepare:
 - Soak 2 tablespoons of fenugreek seeds overnight, then grind them into a paste.
 - Mix the paste with 2 tablespoons of yogurt and 1 tablespoon of olive oil.
 - Apply to hair and scalp for 30-40 minutes, then rinse thoroughly.
 - Best for: Strengthening hair and reducing hair fall.

4. Peppermint & Tea Tree Oil Hair Mask

- Ingredients: Peppermint oil, tea tree oil, yogurt, and honey
- Benefits: Both peppermint and tea tree oil promote scalp health, stimulate hair follicles, and fight dandruff. Yogurt helps hydrate the scalp and moisturize hair.
- How to Prepare:
 - Mix 2 tablespoons of yogurt, 1 tablespoon of honey, and 5-6 drops each of peppermint and tea tree oil.
 - Apply the mixture to the scalp and hair, leave it for 20-30 minutes, then wash with a mild shampoo.
 - Best for: Cooling, stimulating the scalp, and treating dandruff.

ADVANTAGES OF HERBAL HAIR MASK :

- Nourishes the scalp
- Promotes hair growth
- Reduces hair fall
- Treats dandruff and itching
- Balances oil production
- Repairs hair damage

D) HERBAL RINSES:

Herbal rinses are natural hair care treatments made by infusing water with herbs. They are used as a final rinse after shampooing and conditioning to improve scalp health, enhance hair texture, and address specific hair concern.

Herbal rinses often include ingredients like;

- ✓ Apple Cider Vinegar: Apple cider vinegar helps to restore the pH balance of the scalp, preventing fungal growth and removing flakes.
- ✓ Chamomile: Chamomile has soothing properties and can help calm an irritated scalp while reducing dandruff.
- ✓ Rosemary: Improves circulation to the scalp and helps reduce scalp irritation.

ADVANTAGES OF HERBAL RINSES

- Improves scalp health
- Strengthens hair
- Promotes hair growth
- Enhances shine and texture

E) HERBAL SCALP TREATMENTS:

They are natural remedies designed to nourish, cleanse, and rejuvenate the scalp using plant-based ingredients. These treatments target common scalp issues such as dandruff, dryness, itching, and excess oil production while promoting healthy hair growth.[7][8]

Here are some common ingredients in Herbal Scalp Treatments:

- Tea Tree Oil: Tea tree oil is one of the most effective natural treatments for dandruff. It can be diluted and used as a leave-in treatment to help fight dandruff-causing fungi.
- Lavender Oil: Lavender oil has antifungal and antibacterial properties, making it useful for reducing dandruff while promoting a healthy scalp.
- Peppermint Oil: Peppermint oil cools the scalp and improves circulation, which can help prevent dandruff.

ADVANTAGES OF HERBAL SCALP TREATMENTS:

- Improves scalp health
- Promotes hair growth

- Reduces dandruff
- Strengthens hair roots
- Balances oil production

F) HERBAL TEAS

They are natural solutions used for internal health benefits (teas) and external hair care (rinses). They both utilize the healing properties of herbs and plants to improve overall well-being and promote healthier hair and scalp.

- ✓ Sage: Known for its ability to balance oil production and its antimicrobial properties, sage can help treat dandruff caused by an oily scalp.
- ✓ Rosemary: Rosemary stimulates circulation and helps maintain scalp health.
- ✓ Lavender: Lavender calms irritation and helps prevent dandruff by maintaining a balanced scalp environment.

•Sage Tea Rinse: Boil a handful of sage leaves in water, strain, and allow it to cool. Pour the cooled tea over your scalp as a final rinse after shampooing.

•Rosemary & Lavender Rinse: Steep fresh or dried rosemary and lavender in hot water, strain, and use as a rinse for the scalp.

ADVANTAGES OF HERBAL TEAS AND RINSES

- Rich in nutrients
- Promotes hair growth
- Reduces hair fall

G) HERBAL POWDERS:

Herbal powders for hair care are powdered forms of plants and herbs that have been traditionally used for enhancing hair health, treating scalp conditions, and promoting hair growth. These powders are known for their natural properties and are typically free from chemicals, making them a popular choice for those seeking natural alternatives to commercial hair products.[9]

Here are some commonly used herbal powders for hair care:

•Shikakai: Shikakai is a natural cleanser that removes excess oil and flakes without stripping the scalp of its natural moisture.

•Brahmi Powder: Brahmi is known for its ability to soothe an irritated scalp and reduce dandruff.

•Multani Mitti (Fuller's Earth): A natural clay that helps cleanse the scalp, absorbing excess oils and impurities that contribute to dandruff.

Advantages of Herbal Powders:

- Promotes Hair growth
- Strengthen Hair
- Improve Scalp health
- Natural Hair Colour
- Reduce Hair Loss
- No harsh chemicals
- Detoxifies hair
- Moisturize and condition

H) Herbal Capsules and Tablets (supplements):

Herbal capsules and tablets are a convenient way to take herbal supplements. They come in pre-measured doses, making it easier to incorporate various herbs into your routine without the need to prepare teas or tinctures. The capsules or tablets contain powdered herbs or concentrated extracts, depending on the product.

- Zinc: Zinc supplements can help regulate the skin cells of the scalp and reduce the risk of dandruff.
- Omega-3 Fatty Acids: Found in fish oil and flaxseed, omega-3 fatty acids help maintain healthy skin, including the scalp.
- Probiotics: Support a healthy balance of microorganisms in the body, which can help reduce scalp issues, including dandruff.
- Biotin: Biotin supports healthy hair and scalp growth and may help reduce dandruff.

Advantages of Herbal Supplements:

1. Convenience
2. Precise dosage
3. Long shelf life

4. Taste masking
5. Portability
6. No need for preparation
7. Better absorption
8. No mess

Herbs with antidandruff and antifungal properties

Herbs have been used for centuries to improve hair health, and they offer several benefits for various hair conditions.

Herbs and medicinal plants are rich in antioxidants, known to treat different diseases. The antioxidant potential is tested at various levels.

Various herbs have anti-inflammatory, anti-microbial and anti-fungal properties. They also help improve blood circulation and nourish the scalp.

Here are some key advantages:

1. Nourishing and strengthening
2. Stimulate Hair Growth
3. Reduce Hair Loss
4. Treat Dandruff and scalp issues
5. Condition and moisturize
6. Reduce Frizz and Split Ends
7. Natural and Chemical free
8. Improves scalp health

Below are some herbs which show therapeutic properties for the treatment of dandruff;

Table 1: Herbs used in the preparation of antidandruff and antifungal preparations [10]

HERBS	Property
Neem (Azadirachta indica)	Strong antifungal and antibacterial properties.
Tea Tree (Melaleuca alternifolia)	Effective antifungal and anti-inflammatory effects
Rosemary (Rosmarinus officinalis)	Helps reduce dandruff due to its antimicrobial properties
Thyme (Thymus vulgaris)	Contains thymol, which has antifungal and antibacterial qualities.
Aloe Vera (Aloe barbadensis)	Has soothing and antifungal properties.
Basil (Ocimum basilicum)	Natural antifungal agent, also helps with scalp circulation.
Fenugreek (Trigonella foenum-graecum)	Contains nicotinic acid and proteins beneficial for dandruff control
Bhringraj (Eclipta alba)	Known for antifungal and antimicrobial effects that aid in treating scalp issues
Hibiscus (Hibiscus rosa-sinensis)	Contains antifungal properties that help with dandruff.
Peppermint (Mentha piperita)	Its menthol content has antifungal and cooling effects.
Holy Basil (Tulsi, Ocimum sanctum)	Has potent antifungal and antibacterial properties.
Lemongrass (Cymbopogon citratus)	Known for its antifungal activity and soothing effects on the scalp
Calendula (Calendula officinalis)	Contains antifungal and anti-inflammatory properties that promote scalp health
Sage (Salvia officinalis)	Antimicrobial properties make it effective for treating dandruff.
Garlic (Allium sativum)	Has strong antifungal compounds like allicin, which help combat dandruff.
Clove (Syzygium aromaticum)	Contains eugenol, which has antifungal and antibacterial effects.
Lavender (Lavandula angustifolia)	Offers antifungal properties and helps soothe an itchy scalp.
Chamomile (Matricaria chamomilla)	Has antifungal and calming properties beneficial for scalp health.
Horsetail (Equisetum arvense)	Known for its antifungal and anti-inflammatory benefits.
Bay Leaf (Laurus nobilis)	Contains natural antifungal compounds that can help manage dandruff.
Moringa (Moringa oleifera)	Has antifungal and antimicrobial properties beneficial for scalp health.

Black Seed (<i>Nigella sativa</i>)	Known for its antifungal, antibacterial, and anti-inflammatory effects.
Amla (Indian Gooseberry, <i>Phyllanthus emblica</i>)	Helps maintain scalp health and prevent dandruff due to its antifungal qualities.
Cinnamon (<i>Cinnamomum verum</i>)	Contains cinnamaldehyde, which has antifungal and antibacterial properties
Eucalyptus (<i>Eucalyptus globulus</i>)	Has antifungal and cooling properties that help soothe scalp irritations.
Turmeric (<i>Curcuma longa</i>)	Contains curcumin, known for its antifungal and antibacterial effects
Ginger (<i>Zingiber officinale</i>)	Known for its antifungal and antimicrobial effects, promoting scalp health.
Oregano (<i>Origanum vulgare</i>)	Contains carvacrol and thymol, which have strong antifungal properties.
Marigold (<i>Tagetes erecta</i>)	Has antifungal and antibacterial qualities that can help soothe the scalp.
Ashwagandha (<i>Withania somnifera</i>)	Contains compounds that help maintain scalp health and reduce inflammation
Yarrow (<i>Achillea millefolium</i>)	Known for its antiseptic and antifungal properties.
Mugwort (<i>Artemisia vulgaris</i>)	Has antifungal and antibacterial properties beneficial for scalp treatment
Plantain (<i>Plantago major</i>)	Contains antimicrobial and antifungal compounds that help treat dandruff
Dandelion (<i>Taraxacum officinale</i>)	Known for its antifungal and anti-inflammatory properties.
Pine Needle (<i>Pinus</i> spp.)	The oil extracted from pine needles has antifungal and antimicrobial benefits.
Lemon Balm (<i>Melissa officinalis</i>)	Contains antifungal and calming properties that can soothe an irritated scalp.
Valerian Root (<i>Valeriana officinalis</i>)	Has antifungal and soothing effects that promote scalp health.
Pau d'Arco (<i>Tabebuia impetiginosa</i>)	The inner bark has antifungal properties due to lapachol.
Blue Chamomile (<i>Matricaria recutita</i>)	Another type of chamomile known for strong antifungal and soothing benefits.
Sweet Flag (<i>Acorus calamus</i>)	Traditional remedy with antifungal properties, used for hair care.
Patchouli (<i>Pogostemon cablin</i>)	Contains antifungal and anti-inflammatory properties.
Cedarwood (<i>Cedrus</i> spp.)	Has antifungal and scalp-soothing properties, commonly used in hair treatments
Stinging Nettle (<i>Urtica dioica</i>)	Contains antifungal properties and is often used in hair care.
GotuKola (<i>Centella asiatica</i>)	Offers antimicrobial benefits and helps maintain scalp health.

Plant Parts and Seeds

Table 2: Plants parts used in preparation of antidandruff formulations

Flaxseed (<i>Linum usitatissimum</i>)	Rich in omega-3 fatty acids and has anti-inflammatory and antifungal properties beneficial for the scalp.
Pumpkin Seed (<i>Cucurbita pepo</i>)	Contains antifungal properties and is rich in zinc, which helps in maintaining scalp health
Mustard Seed (<i>Brassica spp.</i>)	Has antifungal and antimicrobial effects.
Fenugreek Seeds (<i>Trigonella foenum-graecum</i>)	Used in hair masks for their antifungal and soothing properties.

Fruits

Table 3: Fruits used in preparation of antidandruff formulations [11]

Lemon (<i>Citrus limon</i>)	High in citric acid, which helps balance the scalp's pH and fight dandruff with its antifungal properties.
Orange (<i>Citrus sinensis</i>)	Contains citric acid and vitamin C, which help cleanse the scalp and reduce dandruff.
Avocado (<i>Persea americana</i>)	Contains antifungal properties and rich moisturizing agents that prevent scalp dryness.
Banana (<i>Musa spp.</i>)	Has antifungal properties and helps soften and nourish the scalp.
Papaya (<i>Carica papaya</i>)	Contains papain, an enzyme that helps remove scalp buildup and has mild antifungal effects
Coconut (<i>Cocos nucifera</i>)	Coconut oil has antifungal properties due to lauric acid, making it effective for dandruff treatment.
Apple (<i>Malus domestica</i>)	Apple cider vinegar derived from apples has antifungal and pH-balancing properties for the scalp

Vegetables

Table 4: Vegetables used in the preparation of antidandruff formulations

Onion (<i>Allium cepa</i>)	Contains sulfur and antifungal compounds that help with dandruff and promote hair health.
Garlic (<i>Allium sativum</i>)	Known for its strong antifungal properties due to allicin
Beetroot (<i>Beta vulgaris</i>)	Contains antioxidants and antifungal properties that can help improve scalp health
Carrot (<i>Daucus carota</i>)	Rich in vitamins A and C, which promote a healthy scalp and have mild antifungal benefits.
Cucumber (<i>Cucumis sativus</i>)	Its cooling and antifungal properties can soothe an irritated scalp.

Other Natural Ingredients

Table 5: Natural ingredients used in the antidandruff formulation

Apple Cider Vinegar	Derived from apples, it helps balance scalp pH and has strong antifungal effects.
Aloe Vera Gel	Extracted from the aloe plant, it has antifungal, soothing, and moisturizing properties.
Witch Hazel (<i>Hamamelis virginiana</i>)	Used for its astringent and antifungal properties.
Raw Honey	Has natural antifungal and antibacterial properties that help reduce dandruff.
Yogurt	Contains probiotics that can help balance the scalp's natural flora and prevent dandruff

CONCLUSION

Dandruff is a common scalp condition that causes irritation and hair health issues. While medicated shampoos with antifungal agents like ketoconazole and zinc pyrithione offer relief, they may have side effects and risk resistance development. As a result, natural remedies are becoming a preferred alternative due to their holistic benefits and minimal adverse effects. Herbal treatments like neem, tea tree oil, rosemary, hibiscus, fenugreek, and aloe vera have antifungal, anti-inflammatory, and scalp-nourishing properties. They help control dandruff by inhibiting *Malassezia furfur*, balancing oil production, and soothing irritation. These ingredients are found in herbal shampoos, oils, and masks, offering diverse treatment options.

Herbal remedies are affordable, eco-friendly, and free from harsh chemicals, promoting long-term scalp health and stronger hair. While more clinical research is needed, combining these natural solutions with a healthy diet, stress management, and proper scalp care provides an effective and sustainable approach to dandruff management.

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