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"Formulation and Evaluation of Polyherbal Hair Serum

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ABSTRACT:
The demand for cosmetics is growing, and many people use them regularly. Herbal cosmetics are popular because they tend to have fewer side effects and are safer to use. One product of interest is a hair serum that keeps the scalp hydrated and encourages new hair growth.

Our country has many plants that can be used in these products, and traditional knowledge from systems like Ayurveda, Siddha, Unani, and Tibetan medicine can help identify useful plant compounds for skincare.

Keyword:-Herbal hair serum, Grape seed oil, peppermint oil, Guar gum, Evaluation of herbal hair serum

I. INTRODUCTION:

In recent years, the beauty and personal care industry has shifted toward natural and herbal product. This change is driven by concerns over synthetic ingredients and a desire for safer, sustainable options. One exciting trend in this area is the use of poly herbal formulations, especially in hair care [1,2]

Poly herbal hair serums combine various plant extracts to address different hair & scalp needs. These serums benefit from the combined effects of multiple herbs, providing a broader range of advantages. This approach draws on ancient practices from cultures like Ayurveda in India and Traditional Chinese Medicine, which have long valued the healing properties of plants for hair growth and scalp health .[3]

The appeal of poly herbal hair serums lies in their ability to tackle various hair issues, such as thinning, breakage, dryness, and dandruff. By carefully selecting herb that promote hair growth and nourish the scalp, formulators can create tailored solutions. These serums aim not just to improve appearance but also to support long-term hair and scalp health. [4]


Fig.1: Polyherbal Hair

However, while these products are gaining popularity, more scientific research is needed to confirm their benefits and ensure they are safe to use. This thesis will explore poly herbal hair serums, looking at how they are made, their effectiveness, and the science behind their benefits. By studying the interactions between herbal ingredients and hair health, the review aims to provide insights that could change the hair care industry for the better.[5]

The following sections will discuss the reasons for using poly herbal formulations, review relevant studies on herbal extracts in hair care, outline the study's objectives, and explain the methods used in the research. This work hopes to contribute to the field of herbal cosmetics, offering safer and more effective solutions for hair and scalp health.

- **Hair:**

Hair is a thin, thread-like structure made of a protein called keratin, measuring about 0.1 mm thick. It grows from hair follicles located in the deeper layer of skin called the dermis. Only mammals have hair, and it can be found in many places on the body, except for the palms of the hands, soles of the feet and certain parts of the lips.

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There are four types of hair follicles, each producing a different type of hair:
1. Lanugo hair follicles: make soft, fine hair usually found on newborns.
2. Vellus hair follicles: produce fine, light hair that covers most of the bod
3. Intermediate hair follicles: create hair that's between fine and thick, often found in areas like the arms and legs.
4. Terminal hair follicles: make thick, coarse hair, like on the scalp, eyebrows, and other body parts

Each hair has two main parts: the hair shaft, which is the visible part above the skin, and the root, which is below the skin. Hair goes through cycles of growth (anagen), transition (catagen), and resting (telogen), which allows new hair to grow.[6,7]

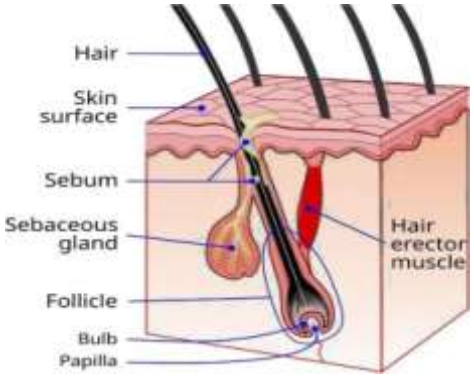

Fig. 2: Structure of Hair

Hair Follicle:

The hair follicle (HF) is a complex mini-organ made up of various layers of cell including more than 20 different cell types. It has two main parts : a permanent outer structure and a changing inner part, known as the bulb. The bulb is where hair growth happens, with keratin-producing cells sitting on supportive dermal cells.[8]

Hair goes through cycles of growth (anagen), regression (catagen), and resting (telogen). Recently, shedding (exogen) has been recognized as an active process. These phases are controlled by a complex system of signals involving different molecules in the body

Hair follicles are surrounded by a network of blood vessels and nerves and include specialized cells like melanocytes (which provide color) and immune cells.[9]

At birth, a person has about 5 million hair follicles, with 80,000 to 150,000 on the scalp. The exact process that starts the formation of hair follicles and controls the hair growth cycle is not fully understood. However, it is known that moving from one phase of the hair cycle to another depends on signals and the activity of various proteins, chemicals, and hormones. [10]. Understanding how these factors affect the hair growth cycle is important because it can help us find ways to control or stimulate hair growth.

The length of hair depends on how long the growth phase (called the anagen phase) lasts. On the human scalp, the anagen phase can last anywhere from 2 to 6 years, which is much longer compared to other parts of the body [11]

- **Anatomy of the Hair Follicle**

The mature anagen hair follicle is organized into different sections, both vertically and horizontally.

Here are the three main vertical parts of the hair follicle, from the outermost to the innermost:

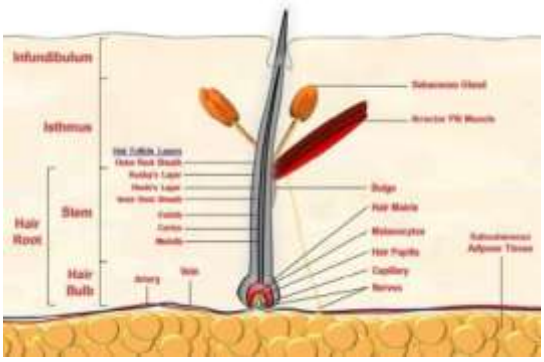

Fig. 3: Structure of hair follicle

- **Upper Follicle**: This includes the infundibulum and the isthmus.
- **Middle Follicle**: This part contains the bulge, which is important for hair regeneration.
- **Lower Follicle:** This section includes the suprabulbar and bulbar areas, which regenerate during the hair growth cycle.

The outer parts of the follicle (upper and middle) are permanent, while the lower part changes with each hair cycle

The main components of the hair follicle, from outermost to innermost, are: Connective Tissue Sheath, Outer Root Sheath, Inner Root Sheath (IRS) , Cuticle , Hair Shaft Cortex Medulla.

The Inner Root Sheath

The inner root sheath runs from the bulb to the isthmus and is found between the outer root sheath and the hair shaft. The IRS is composed of

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middle cylinder of the follicle [12] The IRS contains three layer

- Cuticle of IRS: Made up of scales that point downwards, interlocking with similar scales on the hair shaft.
- Huxley's Layer
- Henle's Layer

- **Hair Shaft**

The hair shaft is the visible part of hair that extends above the scalp. It is made up of dead cells, keratin (a type of protein), binding materials, and small amounts of water. The hair shaft has three main parts:

- **Cuticle**: The outer layer made of overlapping cells.
- **Cortex**: The middle layer, which provides strength and color.
- **Medulla**: The innermost layer, which may be absent in some hair types.[13 -14]

- **Hair Follicle Bulb**

The bulb is the round, deep part of the hair follicle that surrounds the dermal papilla. This bulb contains matrix cells, which are living cells that actively divide and grow. As these cells multiply, they push older cells upwards, causing them to change and harden into the hair cortex. The matrix cells in the bulb grow faster than any other cells in the body. When these cells reach the upper part of the bulb, they begin to organize into six layers, with three of the inner layers forming the actual hair.[15]

- **Dermal Papilla**

The dermal papilla (DP) is a small, rounded structure that plays a key role in forming hair follicles. It contains active cells that help develop the follicle from the skin's outer layer (epidermis). The DP is made up of spindle-shaped cells, fibroblasts, collagen fibers, nerve fibers, and a tiny blood vessel loop. It is connected to the surrounding connective tissue that supports the lower part of the hair follicle[16]

Morphogenesis of Hair:

Hair development begins in the fetus around 8 weeks of gestation when certain structures called placodes form in the skin's outer layer (epidermis) above clusters of cells in the deeper layer (dermis). As these structures grow, they enclose the dermal papilla cells, leading to the formation of the hair follicle. By 22 weeks, the first growth of hair, known as lanugo[17], appears as a fine coating that starts from the front of the scalp and moves to the back. This first coat of lanugo is shed by 36 weeks.

After birth, a second layer of lanugo develops, which is also shed in a wave-like pattern about 3-4 months later. It's common for infants to have a bare patch on the back of their heads due to this synchronized shedding before normal scalp hairs take over.

At birth, the highest number of hair follicles is present, with the density being greatest in newborns. As children grow, the density of hair follicles decreases until it stabilizes in adulthood, averaging 250-300per centimeter square.[18]

After the first year of life, the synchronized pattern of hair cycling changes to a random or mosaic pattern. Hair follicles continue to cycle through growth, rest, shedding, and regrowth throughout life. 3-4 months later[19]. It's common for infants to have a bare patch on the back of their heads due to this synchronized shedding before normal scalp hairs take over.

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Types of Hair

On the scalp, there are two main types of hair:

- Terminal Hairs: These are thick, long, and pigmented, averaging over 0.03 mm in diameter and often exceeding 1 cm in length. They can be classified as small, medium, or large based on their diameter.
- Vellus Hairs: These are fine, short hairs that are less than 0.03 mm in diameter, often not noticeable, and usually less than 1 cm long. They lack pigment and the central medulla[20] .Some terminal hairs can shrink to the size of vellus hairs due to various factors. Hair Cycle Stages[

The hair growth cycle includes several phases:

- Anagen (Growth Phase): The active phase where hair grows.
- Catagen (Transition Phase): Marks the end of the growth phase. During this time, the hair

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shaft shrinks, and the outer root sheath recedes as cells die off.

- Telogen (Resting Phase): The hair rests before eventually shedding. This cycle continues throughout a person's life, allowing for new.

The Hair Cycle:

The hair cycle describes the changes in hair growth and follicle structure over time. All body hairs go through this cycle, but the duration of each phase and the length of the hair can vary widely depending on the location on the body.

Each hair follicle has its own unique growth pattern, so hair growth is not synchronized between nearby follicles in humans and guinea pigs. In contrast, many rodents experience synchronized hair growth in waves that move from the back to the tail, influenced by neighboring follicles[21] and general stimuli.

Research suggests that these growth waves are controlled by internal factors within the group of hair follicles, using a system known as "reaction diffusion." Neighboring follicles and systemic factors, like hormones, can also affect this rhythm. In some experiments, hair growth waves have been shown to synchronize over time in rats that share a blood supply.

The hair growth cycle follows a specific timeline, including phases of growth (anagen), rest (telogen), and transition (catagen). However, factors such as genetics, sex (for example, females may have longer resting phases), and environmental influences (like season, temperature, and light) also play significant roles in the cycle.

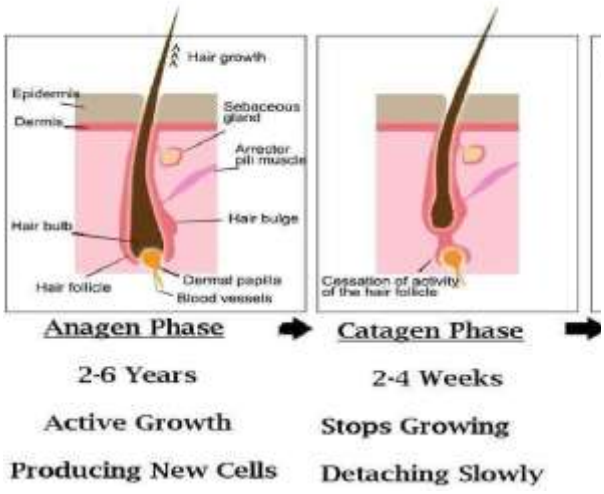

Fig. 4: The Hair Cycle

Hair Growth Cycle:

- **Anagen (Growth Phase):**

This is the active phase where hair is growing. Cells in the hair follicle multiply quickly, forming the hair shaft. This phase can last from several years (like on the scalp) to a few weeks (like on arms and legs), depending on genetics.

- **Catagen (Transition Phase):**

This is a short phase that occurs after anagen. The hair follicle starts to shrink, and hair growth stops. Cells in the lower part of the follicle die off, and the hair becomes attached to the follicle, forming what's called a club hair.

- **Telogen (Resting Phase):**

In this phase, the hair follicle is inactive, and the hair may stay in place for several months. The follicle shrinks, and the hair shaft becomes less anchored. There's little to no production of hair-related proteins.

- **Exogen (Shedding Phase):**

This phase involves the shedding of the old hair. The hair shaft is released from the follicle. The remaining root structure is less dense compared to the telogen phase.

- **Kenogen (Empty Follicle Phase):**

After shedding, the hair follicle is empty before a new hair starts to grow. This phase can last longer in people with certain types of hair loss. Each of these phases plays a crucial role in the overall health and growth of hair![22]

Duration of the Hair Cycle:

The length of each phase in the hair growth cycle varies depending on the type of hair follicle and its location on the body

- **Anagen (Growth Phase):**

On the scalp, 85% of hair is in this growth phase, which can last from 2 to 6 years. Some people may have even longer anagen phases, resulting in very long hair. The length of the hair is mainly determined by how long the anagen phase lasts.

- **Telogen (Resting Phase):**

About 15% of scalp hair is in this resting phase at any given time. Hair follicles on the body (like arms and legs) tend to spend more time in telogen compared to scalp hair[23]

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Overall Cycling:

Each hair follicle continues to cycle throughout a person's life.

During anagen, a complete hair shaft is formed. In the catagen phase, two-thirds of the hair follicle undergoes cell death (apoptosis).

II. MATERIALS AND METHODS

- **GRAPESEED OIL:**

Form: Liquid at room temperature
Color: Pale yellow to greenish
Odor: Mild, characteristic aroma
Melting Point: Approximately -6 to -10°C
Boiling Point: Approximately 216-222°
Density: About 0.915-0.925 g/cm³ at 20°C

Uses:

1. Skincare: Moisturizes and is often used in beauty products for its antioxidant properties.
2. Culinary: Good for frying and sautéing due to its high smoke point and neutral flavor.
3. Dietary Supplement: Provides essential fatty acids and antioxidants, potentially benefiting heart health and reducing inflammation.
4. Massage Therapy: Commonly used as a carrier oil because of its smooth texture.
5. Hair Care: Helps moisturize the scalp and improve hair health and shine.

Industrial Applications: Used in cosmetics, soaps, lubricants, and pharmaceuticals

- **SWEET ALMOND OIL:**

Form: Liquid at room temperature
Color: Pale yellow to golden
Odor: Mild, sweet, nutty aroma
Melting Point: Approximately -17 to -20°C
Boiling Point: Approximately 230-240°C
Density: About 0.910-0.915 g/cm³ at 20°C
Uses: Skincare: Known for its moisturizing.

- ARGON OIL:

Form: Liquid at room temperature
Color: Golden yellow
Smell: Mild, nutty aroma

Uses:

Skincare: Moisturizes and soothes skin, helps reduce signs of aging, and can treat skin conditions. Hair Care: Conditions hair, reduces frizz, and may promote hair growth. Aromatherapy: Used as a carrier oil to mix with essential oils.

Nail Care: Strengthens nails and cuticles, preventing dryness. Healing: Helps with inflammation and minor wounds.

- **PEPPERMINT OIL:**

IUPAC Name: (1R,2S,5R)-5-methyl-2-(propan-2-yl) cyclohexan-1-ol

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Molecular Formula: C10H20O
Color: Clear to pale yellow
Smell: Strong, minty aroma
Uses: Aromatherapy:

- YLANG YLANG OIL:

Form: Liquid at room temperature
Color: Pale to golden yellow
Smell: Sweet, floral aroma
Uses: Aromatherapy: Promotes relaxation and improves mood. Skincare: Balances oil production and moisturizes the skin. Hair Care: Nourishes hair and may prevent breakage.

- VITAMIN-E:

IUPAC Name: (2R)-2, 5, 7, 8-tetramethyl-2-[(4R, 8R)-4, 8, 12-Trimethyltridecyl]-3, 4-dihydro-2H-chromen-6-ol
Molecular Formula: C29H50O2
Molecular Weight: 430.71 g/mol
Form: Liquid or solid
Colour: Yellow to reddish-brown
Odor: Generally, odorless or may have a mild scent
Melting Point: Varies; for alpha-tocopherol, around 2-5°C; tocopherol acetate, 25-30°C
Boiling Point: Decomposes before boiling
Density: Varies; alpha-tocopherol is about 0.95-0.97

- **EVALUATION OF POLYHERBAL HAIR SERUM:**

1. Physical appearance
2. Homogeneity
3. pH test
4. Viscosity
5. Stability
6. Microbial Contamination

1. Physical Appearance:
The physical appearance, color, and feel of the prepared herbal hair serum are visually tested.[26]

2. Homogeneity Test
A clean and dry object glass was smeared with the hair serum, The appearance under the light of some coarse particle/homogeneity was investigated. Herbal hair serum was tested by visual examination for homogeneity and tested for some lumps, flocculates. [27].

3. pH Test
The pH meter was calibrated using pH 4 and pH 7 buffer solutions. Then, the electrode was soaked in the hair serum and left until the pH normalized after a few minutes [28].

4. Viscosity
The viscosity measurement was performed with spindle number 6 on a Brookfield viscometer. In the beaker, 50 ml of hair serum was placed.

5. Stability
The herbal hair serum was kept for three months at two separate temperatures of 4± 2°C and 30± 2°C. Compared with the original pH and viscosity, the pH and viscosity of the herbal hair serum were determined after three months [29].

6. Microbial Contamination
Nutrient agar medium is used for the antimicrobial assay. Nutrient agar was prepared by it's prescribe procedure and autoclaved at 121°C for 45 minutes. The sterilized media was allowed to cool at 37°C. Plate were filled with nutrient agar solution and allowed for solidification. After solidification, the microorganisms from the subculture were inoculated into the nutrient agar medium. Sub-cultured Bacteria were inoculated by striking on the surface media of the petri plate and

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subjected to incubation. These were immediately poured into it and kept for incubation for 24 hours at 37°C for growth of microorganisms [30]

III. CONCLUSION

The main objective of the present study was to develop hair serum by using poly herbal like, Grapeseed oil, Sweet almond oil, Argon oil, Peppermint oil, Ylang oil and Vitamin E.

Results have shown that herbal hair serum provides various essential nutrients needed to preserve the proper function of the sebaceous glands and support the growth of natural hair. In the personal hygiene and health care system, the use of herbal cosmetics has changed by several folds. Therefore, the herbal cosmeceutical individual care or personal health care industry, which is actually concentrating and paying extra care on the production of herbal-, based cosmetics. All the evaluation parameters like Physical appearance, Homogeneity, pH test, Viscosity, Stability and Microbial Contamination showed that they are within the limits and since all the ingredients added have many advantages, this hair serum will help in maintaining good growth of hair, essential nutrients needed to preserve the proper function of the sebaceous glands and support the growth of natural hai

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