International Journal of Science and Research Archive
eISSN: 2582-8185
Cross Ref DOI: 10.30574/ijsra
Journal homepage: https://ijsra.net/

(REVIEW ARTICLE)

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A review: Polyherbal hair dye

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International Journal of Science and Research Archive, 2024, 12(01), 2158–2168

Publication history: Received on 13 April 2024; revised on 27 May 2024; accepted on 30 May 2024

Article DOI: https://doi.org/10.30574/ijsra.2024.12.1.0911

Abstract

The composition of natural hair dye consisting of amla , henna , tea powder , beet root , clove powder,meethi seed powder, curry leaves powder are blended with lemon peel powder. Conventional hair coloring techniques use chemicals , which can have unfavorable side effects such as skin discoloration ,inflammation , hair breakage, and cancer. The goal of the current study used to investigate the formulation of those plants using variousorder to improve the quality and effectiveness of the colorant activity. Graying hair is a normal occurrence linked to aging and regular use of synthetic shampoos, which is promote the use of synthetic colors due to the rise in the use of dangerous chemicals during the manufacturing process. We preferred using polyherbal hair color for that reason.

Keywords: Safety; Hair dye; Conventional; Polyherbal; Quality

1. Introduction

Breast cancer (BC) is a significant health issue and the most common malignancy in women worldwide, early detection Natural herbal hair dyes are more popular these days than chemical-based hair dyes, which can lead to skin conditions and other skin-related problems. The majority of people nowadays are quite conscious about their appearance, and hair plays a major role. For healthy hair, herbal medications that have no side effects are employed. Approximately 70% of People over 50 years with hair graying and balding[1].

According to a Danish population-based study, approximately 75% of women and 18% of men have colored their hair at some point in their life, indicating its popularity (median age of debut was 16 years

A dye is a color substance that has the affinity to color the fiber, fur, or hair [5]. Natural dyes have been used to dye carpets, rugs, and garments since ancient times. Plants with dye-producing roots stems, bark, leaves, berries, and flowers are used. The process of changing the color of hair is known as hair coloring or hair dyeing.

This is primarily due to cosmetic reasons: can cover up white or gray hair, switch to a more refined or perfect hue, or restore the original color of the hair after It has become discolored due to sun bleaching or hair coloring treatments. Hair color functions as an additional layer for your hair. As a result, the hair seems thicker and more voluminous. In this case, choosing a semi-permanent hair color is always a great idea because it gives your hair strength and improves its appearance of health. Every day, our hair is exposed to a variety of harmful environmental elements, such as dirty air, excessive heat, and fluctuating temperatures [8].

Although graying of hair is a natural part of aging, premature graying has been linked to stress and the use of synthetic shampoos, particularly among women. Hair color loss can be caused by various factors, including genetics,

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environmental factors, and alcohol usage. Scientists believe hydrogen peroxide and catalase may play a crucial part in the process of graying hair, which occurs due to a lack of pigment. Each hair cell produces a small amount of hydrogen peroxide, which gradually accumulates[11]. When compared to synthetic materials that are harmful to human health, the term "herbal" denotes safety. Human skin, eyes, and hair are colored by melanin. Your natural hair color is determined by the ratio of two types of melanin i.e. eumelanin, and pheomelanin.

1.1. A brief overview of natural colorants' history

The use of colorants dates back to the Stone Age, and many ancient civilizations expanded their use of dyes to textiles once weaving techniques advanced. Among the popular ancient dyes were madder, blue indigo, and yellow made from turmeric or saffron; charcoal, ochre, and limestone were all significant pigments. Animals, minerals, and plants were the main sources of natural colorants. Almost every component of a plant, including the leaves, roots, fruit, flowers, bark, wood, and seeds, was used to create a variety of colors and their combinations. While colorful minerals were the primary pigments used in the Stone Age, bio-colorants and minerals were also used by the Phoenicians, Ancient Indians, Ancient Romans, Ancient Egyptians, and Ancient Africans[17].

1.2. Hair Growth Cycle

1.2.1. Anagen phase

The Anagen Phase, also known as the 'Growth Phase' or 'Active Phase,' occurs when the cells in the root of your hair divide the most rapidly, resulting in the formation of more new hair. During the Anagen Phase, your hair grows at a rate of half an inch per month [approximately 6 inches per year], and faster in the summer than in the winter. Anagen follicles are long and straight. The hair coat is angled to lie level on the body surface. Proliferating matrix cells have a cell cycle of about 18 hours. Daughter cells ascend via six IRS and HS lineages, from outermost to innermost. The IRS layers are Henley, Huxley, and cuticle, while the HS layers are cuticle, cortex, and medulla. As HS cells differentiate, they expel organelles and form bundles of 10-nm filaments made of cysteine-rich hair keratins. These filaments cross-link, providing the hair shaft with exceptional tensile strength and flexibility[15].

1.2.2. Catagen phase

When the anagen growth phase ends, the catagen phase begins. At the onset of the catagen phase, melanocytes cease producing pigment, hair shaft formation is inhibited, and hair matrix keratinocyte differentiation and proliferation dramatically decline. Apoptosis-induced regression causes the hair follicle to shrink to roughly one-sixth of its original diameter. A unique structure called club hair forms during catagen. The club hair is fixed in the telogen follicle by the keratinized brush-like structure at its base, which is encircled by ORS epithelial cells. The dermal papilla changes into a group of dormant cells that are situated next to the regressing hair follicle epithelium and move from the subcutis to the boundary between the dermis and subcutis to remain in contact with the hair follicle epithelium that is further removed, including the bulge and the secondary hair germ. The duration of this phase is a few weeks[16].

1.2.3. Telogen phase

Encircled by ORS epithelial cells, the keratinized brush-like structure at the base of the telogen follicle holds the club hair in place. To stay in contact with the hair follicle epithelium that is further removed, which includes the bulge and the secondary hair germ, the dermal papilla transforms into a group of dormant cells that are positioned next to the regressing hair follicle epithelium and move from the subcutis to the boundary between the dermis and subcutis. This stage lasts for a couple of weeks[16].

1.2.4. Exogen phase

It is also known as the shedding phase. The exogen phase is simply an extension or component of the telogen phase of hair growth. During the exogen period, which can last 2 to 5 months, new hairs grow in the follicles while old ones fall out[17].

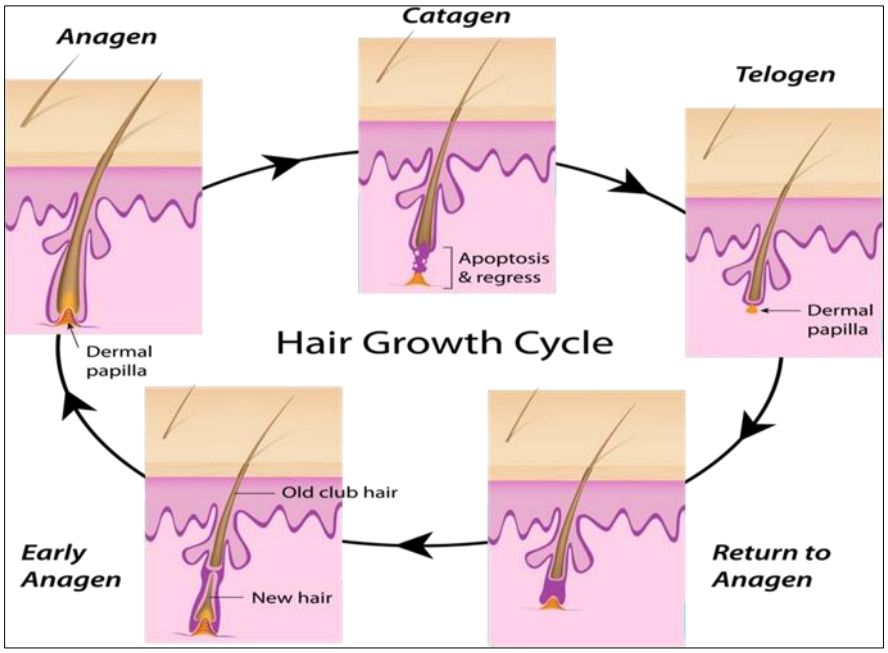

Figure 1 Hair Growth Cycle

1.3. Types of Hair dye

1.3.1. Temporary

- These hair colors are used to color the hair temporarily.
- The colorants employed do not permeate the hair or surroundings.
- Easy to rinse off water after shampooing.
- For temporary hair coloring, use a Puffer Spray with finely crushed metals.
- To add temporary color, use powders, setting lotions, or crayons.
- To create temporary hair coloring, use the leuco derivative of a basic dye, such as crystal violet[7].

1.3.2. Semipermanent

- Semi-permanent dyes typically contain nitrophenylene diamines, nitroaminophenes, or both aminoantrhaquinones.
- Shampoo is the most commonly used base.
- Adding a solvent can improve colorant performance.
- Primary dyes have a natural affinity for hair due to their cationic properties[8].

1.3.3. Permanent

- In a slow oxidation process, the principal intermediates react chemically with modifiers in a coupling reaction.
- Hair can be dyed with a lighter tint than it was originally with permanent dye methods.
- These dyes can mask individual hair color differences.
- Extremely successful on mixed-race black and white hair.
- They do cause some hair damage [8].

1.4. Causes of hair bleaching

- Vitamin Deficiency: Premature graying may be caused by deficiencies in any of the following vitamins: biotin, vitamin D, vitamin E, B-6, or B-12. Research published in the journal Development in 2015 referenced several studies regarding the correlation between hair graying and deficiencies in copper, vitamin B-12, and vitamin D-3. He discovers that pigmentation is impacted by dietary deficits, indicating that vitamin supplementation may restore color.
- Genetics: A 2013 study published in the Indian Journal of Dermatology, Venereology, and Leprology found that a person's first hair graying is mostly inherited. There is also an element of race and ethnicity.

The same 2013 study found that premature graying in white people can begin as early as age 20, whereas in Asians, it can begin as early as age 25.

- Oxidative Stress: Although graying is primarily inherited, the body's oxidative stress can contribute to the premature onset of the process. When antioxidants are not strong enough to counteract the detrimental effects of free radicals, oxidative stress results in an imbalance. Unstable chemicals called free radicals cause cellular damage and play a role in disease and aging. A surplus of oxidative stress can accelerate the onset of several illnesses, such as vitiligo, a skin pigmentation. The loss of function or death of melanin cells in vitiligo can also cause hair to turn white.
- Specific medical ailments Several illnesses, such as autoimmune diseases, might raise the chance of premature graying of the hair. A 2008 study found a connection between thyroid disease and irregularities of the hair. Alopecia areata is an autoimmune skin disease that results in hair loss on the face, scalp, and other regions of the body. White hair is also frequently seen in this condition. Because there is less pigment in the hair, it usually grows back white.
- Smoking: According to a 2013 study that was published in the Italian Dermatology Online Journal, smokers had a 2.5-fold increased risk of developing gray hair. reliable source as nonsmokers thirty years ago. A 2015 study published in the Journal of the American Academy of Dermatology also discovered a connection between young people's premature graying of hair and smoking.
- Chemical hair colors and hair products: Shampoos and other hair products, including chemical hair dyes, can hasten the onset of gray hair.

A lot of these goods include bad components that lower melanin levels. One such dangerous ingredient is hydrogen peroxide, which is present in a lot of hair colors. Hair that has been bleached excessively will eventually become white as well.

Natural hair color levels The typical hair colors of people worldwide are listed below.

- Dark
- The deepest shade of brown
- A deep shade of brown
- tan
- Pale brown
- A dark blond
- blond
- Fair-haired
- very pale blonde
- The platinum.

2. Materials and Methods

2.1. Beetroot

Figure 2 Beetroot

- Botanical name: Beta vulgaris
- Kingdom: Plantae
- Family: Chenopodiaceae

- Genus: *Beta*
- Species: *vulgaris*
- Plant part: Root
- Chemical constituents: Betaxanthin,Betanin
- Role: nourishment for scalp, used as a natural hair color

2.2. Amla powder

Figure 3 Amla powder

- Botanical name: Emblica officinalis
- Kingdom: plantae
- Order: Malpighiales
- Family: euphorbiaceae
- Genus: *Phyllanthus*
- Species: *p. emblica*
- Plant part: Fruit
- Chemical constituents: vitamin C (ascorbic acid), Glutamic acid, alanine, Gallic acid.
- Role: Prevents premature greying, Antioxidant, antibacterial.

2.3. Fenugreek

Figure 4 Fenugreek

- Botanical name: Trigonellafoenum-graecum
- Kingdom: Plantae
- Order: Fabales
- Family: Fabaceae
- Genus: *Trigonella*
- Species: *Foenum-graecum*
- Plant part: Seed
- Chemical Constituents: Diosgenin, Triogenin, flavonoids.
- Role: Antimicrobial dandruff treatment, Strengthens hair and adds shine,

2.4. Clove powder

Figure 5 Clove powder

- Botanical name: Eugenia caryophyllus
- Kingdom: Plantae
- Order: Myrtales
- Family: Myrtaceae
- Genus: *syzygium*
- Species: *s. aromaticum*
- Plant part: Flower buds
- Chemical constituents: eugenol
- Role: Eliminate Dandruff,prevent premature graying of hair.

2.5. Curry leaves powder

Figure 6 Curry leaves powder

- Botanical name: Murrayakoenigii

- Kingdom: Plantae
- Order: Sapindales
- Family: Rutaceae
- Genus: *Murraya*
- Species: *M. koenigii*
- Plant part: Leaves
- Chemical constituents: Bismahanine, murrayanine, Murrayazolinol.

2.6. Heena

Figure 7 Heena

- Botanical name: Lawsonia inermis
- Kingdom: plantae
- Order: Myrtales
- Family: Lythraceae.
- Genus: *Lawsonia*
- Species: *L. inermis*
- Plant part: leaves
- Chemical constituents: Lawsone, Anthraquinones, Glycosides.
- Role: Coloring agent,make hair soft and silky, prevent from dandruff

2.7. Tea powder

Figure 8 Tea powder

- Botanical name: Camellia sinensis (L)

- Kingdom: plantae
- Order: Ericales
- Family: Theaceae camelliaceae
- Genus: *Camellia*
- Species: *C. Sinensis*
- Plant part: leaf
- Chemical constutuents: caffeine,theaflavins, proteins, flavanols, catechins, thearubigins.
- Role: stimulate hair growth, reduce hair loss, remove oiliness from scalp, and treat dandruff.

2.8. Lemon peels

Figure 9 Lemon peels

- Botanical name: Citrus limon
- Kingdom: Plantae
- Order: Sapindales
- Family: Rutaceae
- Genus: *Citrus*
- Species: *c. limon*
- Plant part: Fruit
- Chemical constituents: Limonene, citronella, vitamin C
- Role: Antioxidants, promote hair growth.

2.9. Heena

a substance with a reddish-orange hue found in the plant's dried leaves. Other components of henna, like gallic acid and flavonoids, function as organic mordants during the coloring process.

The henna paste's appropriate consistency for hair adhesion is derived from carbohydrates. Although mixed henna, notably black henna, has been known to cause allergic reactions, natural henna is often hypoallergenic. Chemical compounds made up of 3-aminophenol, 2-nitro-4-phenylenediamine, 2-aminophenol, and paraphenylenediamine´2 are the cause of this. Additionally, henna possesses antifungal properties against the dandruff-causing Malassezia species. Henna balances the pH of the scalp and stops graying hair, thereby preventing premature hair loss. The paste made from henna leaves is used to treat skin conditions like smallpox and jaundice. Henna leaf extract with 70% ethanol showed notable hypoglycemic.

2.10. Amla

Berries obtained from amla enhance the absorption of calcium, helping to make healthier bones, teeth, nails, and hair. It maintains the hair color and prevents premature graying, strengthening the hair follicles. Amla is the richest and most concentrated form of Vitamin C along with tannins found among plants. Whole fruit is used as an active ingredient in hair care preparations. The Vitamin C found in the fruit binds with tannins that protect it from being lost by heat or light. This fruit is also rich in tannins, and minerals such as Calcium, Phosphorus, Fe, and amino acids. The fruit extract is useful for hair growth and reduces hair loss. Amla has antibacterial and antioxidant properties that can help promote the growth of healthy and lustrous hair.

2.11. Reetha

The fruit of this plant is high in mucilage, carbohydrates, fatty acids, saponin, vitamins A, D, E, and K. Dandruff reduction and hair growth enhancement are two benefits of reetha extract [18]. Fruit coat extract is utilized in herbal shampoos as a hair cleaner since it functions as a natural shampoo [19]. Reetha, often known as washing or soapnuts, has long been used in natural hair care products.

When this plant is used regularly, its strong supply of saponins leaves hair full, glossy, and healthy.

2.12. Shikakhai.

Hexacosanol, Spinasterone, Calyctomine, Racimase-A Oleanolic acid, Lupeol, Spinasterol, Lactone, Betulin, Betulinic acid, and Betulonic acid are among its constituents. Dandruff management and hair cleansing are two uses for the extract extracted from its pods [20]. Acacia concinna, sometimes known as shikakai, has a high vitamin C content that is good for hair. Shikakai keeps the hair's natural oils intact and naturally lowers pH levels, keeping the hair looking healthy and shiny. It works well for nourishing and strengthening hair as well. Since amla, reetha, and shikakai complement one another, they are used to create healthy, glossy hair. Each of these components is available in two different forms: a dried fruit form and a powdered form. All hair types can benefit from Amla, Reetha, and Shikakai.

2.13. Tea

Due to its abundance in polyphenols, selenium, copper, phytoestrogens, and melatonin , tea has also been used for a long time as a hair colorant in Ayurvedic medicine and traditional Chinese medicine.

2.14. Hibiscus

It works wonders for boosting the activity of hair growth. Naturally rich in calcium, phosphorus, iron, vitamin B1, vitamin C, riboflavin, and niacin, hibiscus helps to prevent premature graying of hair and encourages the growth of thicker hair. The purpose of this flower is to manage dandruff.

Through the production of flavonoids like anthocyanins and other phenolic components, hibiscus has antioxidant capabilities. By conditioning the hair, it can be utilized to revitalize it.

2.15. Bhringraj:

Treatment A higher number of hair follicles is initiated when 5% petroleum ether extract of bhringraj is applied. The traditional usage of leaf extract based on oil has been to promote hair development and restore natural color to gray hair. Neelibhringaadi Tailam, as mentioned in Ayurveda, is good for giving gray hair its natural color and for encouraging hair growth. Various oils, shampoos, hair dyes, and other preparations call for the usage of Bhringraj.

2.16. Jatamansi

An essential Ayurvedic medicinal, Nardostachys jatamansi is utilized in many ancient medical systems, including Ayurveda, Unani, Siddha, and others Rhizomes and roots are used as a heart tonic, sedative, calming, and to treat vertigo, headaches caused by nerves, low and high blood pressure, among other conditions. Chemical research has focused on the plant's rhizomes and roots since they are rich sources of therapeutic compounds [17].

3. Preparation

3.1. Weighing

Ingredients are collected from medicinal plants. Weigh each ingredient according to the determined quantity.

3.2. Mixing

All the weighing ingredients are mixed homogeneously.

3.3. Filling

After mixing finished hair dye product is filled in an appropriate container.

3.4. Packaging

The finished hair dye product is packed and labeled in an appropriate container.

4. Evaluation parameters

4.1. Organoleptic properties

The physical characteristics of the herbal hair dye, such as its shape, color, and aroma, were observed to conduct the organoleptic test

4.2. Physicochemical evaluation

- PH – pH affects the pharmaceutical consideration as well as it affects hair.
- Washability - Formulation was applied on the skin and then washed with water were checked manually.
- Patch test - A small quantity of paste was applied to the ear back. After 20 minutes this paste was removed and the area was washed carefully. There was no irritation and allergic reactions were seen.
- Stability study- The stability of the prepared formulation was determined by keeping the formulation at different temperature conditions for the period of one month The packed formulation was stored at different temperature conditions viz. At room temperature, 35°C was evaluated for physical parameters. The prepared dye formulation was evaluated for the physical parameters like pH, color, odor, texture and smoothness

4.3. Rheological evaluation

In herbal hair dye, all the rheological parameters, such as particle size, bulk density, tapped density, angle of repose, Hausner ratio, and Carr's index are observed according to the proper procedure.

4.4. Advantages

- Use more natural substances and no chemicals to color your hair.
- Gray hair is covered by natural hair color without any negative side effects.
- Deeply nourishes and conditions hair strands from the inside out.
- Treat the current hair issues and Fit all sorts of hair.
- It has Minimal effects on the environment and is Accessible in an array of color tones.

4.5. Disadvantages

- In certain cases, natural hair may potentially be detrimental.
- The availability of natural colors is another problem.
- Producing it can be challenging due to the availability of raw resources.

5. Discussion

All the goodness of natural components is present in the produced herbal hair coloring. Due to the ideal combination of herbal ingredients, this composition not only works as a hair color but also as a conditioner, nourisher, growth booster, and anti-dandruff agent. Since beetroot serves as the foundational powder and is used for coloring, it can be utilized as a hair colorant. properties all over the world. It also helps to properly condition hair and remove extra oil from the scalp.

6. Conclusion

For that reason, we would rather The herbal hair pack give the hair a very mild shade. Herbal cosmetics have the benefit of being non-toxic. feeds the hair and scalp. The skin receives essential nutrients from this hair mixture. By clearing the scalp of extra sebum, it aids in the treatment of dandruff. Regular usage of this pack leaves colored hair color-free and manageable. Stress, aging, pollution, and arid regions all degrade hair quality.We have discovered the beneficial qualities of the herbal hair pack in this study, but further research is required to uncover other practical advantages. Since natural therapies have fewer adverse effects and are safer than chemical ones, they are now generally recognized.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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